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Doc. No. L170 APO 413 Date 23 August 1945

STAFF EVIDENCE ANALYSIS

DESCRIPTION OF ATTACHED DOCUMENT (Under following headings).

Title and Nature: Neuropathology and Neurophsiology, etc. in wartime Germany written by Major Leo Alexander, MC, ETOUSA, published by CIOS, containing references to killing centers for the insane.

Date: Undated Original (x) Copy ( ) Language: English

If not English, is translation attached: Yes ( ) No ( )

LOCATION OF ORIGINAL (also WITNESS if applicable) as of _____1945:

PERSONS IMPLICATED:

REFERENCES TO INDEX HEADINGS (Key to Par. nos. of Summary below):

ATROCITIES: Against Civilians (1)

NECESSARY PROCESSING TO PUT IN EVIDENTIARY FORM; LEADS:

Authentication by Major Alexander.

SUMMARY OF RELEVANT POINTS (with page references):

1. Patients in mental institutions were killed by gas in such large numbers that autopsies were impossible. The brains, however, were suspended in formalin and sent to laboratories for examination. Nurses and attendants selected the persons to be killed, and they degenerated to picking out the patients who looked sick, or who were problems, or whom they simply disliked. (20-21).

Note: This is only a small part of the report, but it might be used in connection with the report on execution of mental patients. (L-169)

Kenyon

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RESTRICTED

NEUROPATHOLOGY AND NEUROPHSIOLOGY,

INCLUDING ELECTRO-ENCEPHALOGRAPHY,

IN WARTIME GERMANY

RESTRICTED

COMBINED INTELLIGENCE OBJECTIVES

SUB-COMMITTEE

H4916 - 0004

R E S T R I C T E D

NEUROPATHOLOGY AND NEUROPHYSIOLOGY, INCLUDING ELECTRO-ENCEPHALOGRAPHY, IN WARTIME GERMANY

Reported by

LEO ALEXANDER

Major, MC., AUS

Hq. ETOUSA

20 July 1945

CIOS ITEM 24

MEDICAL

Combined Intelligence Objectives Sub-Committee

G-2 Division SHAEF (Rear) APO 413.

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NEUROPATHOLOGY AND NEUROPHYSIOLOGY, INCLUDING ELECTROENCEPHALOGRAPHY IN WARTIME GERMANY.

This report is based on investigation of the Kaiser Wilhelm Institute for Brain Research, formerly at Berlin Buch, parts of the Deutsche Forschungsanstalt fur Psychiatrie (Kaiser Wilhelm Institut) in Munich, the Physiological Institute of the University of Goettingen, and the Luftfahrtmedizinisches Forschungsinstitut of the Luftwaffe, formerly at Berlin.

The Kaiser Wilhelm Institute for Brain Research, formerly in Berlin-Buch, was dispersed to three points :-

(1) Munich, where the section for anatomy and general pathology headed by Dr. H. Spatz is housed on one floor of the Deutsche Forschungsanstalt fur Psychiatrie;

(2) Dillenburg in Hessen-Nassau, where the section for special pathology headed by Dr. J. Hallervorden is located in the Schloss Hotel, and

(3) Goettingen, where the neurophysiologic and electroencephalographic section headed by Dr. A.E. Kornmueller is housed in a series of rooms in Dr. F. H. Rein's new Institute of Physiology at the University of Goettingen Medical School. The genetic section, under Dr. N.W. Timofeeff-Ressovsky, remainded in Berlin-Buch. The director of the entire organization of the Brain Research Institute is Dr. H. Spatz, who succeeded its founder, Dr. Oscar Vogt, before the war. Dr. O. Vogt himself, after his retirement from the Institute, built a small Institute for himself in Neustadt im Schwarzwal where he is said to continue his research work with much of his old vigor unaffected by his present old age. During the war, the facilities of the Institute were in part taken over by the Army and Luftwaffe Medical Corps; some of the professional personnel were commissioned wither in the Luftwaffe or the Army, and after brief assignments elsewhere, in part designed to acquaint them with the military problems of their specialty, in part due to administrative error, were, in 1940, directed back to the Institute as its

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military-medical staff. This system pervaded all the departments of the Institute. These military sections of the Institute were integrated as the "Aussenstelle fur Gehirnforschung des Luftfahrtmedizinischen Forschungs-insrirurs der Luftwaffe", under Oberfeldarzt Dr. H. Spatz, Air Force, and the "Aussenstelle der Militaeraerztlichen Akademie zur Erforschung der Kriegsschaeden des Zentralnervensystems", under Oberfeldarzt Dr. Patzig, Army Medical Corps. However, Army and Air Force doctors were represented in all depar ments. In the electroencephalographic department, for instance, Kornmueller was commissioned in the Army, Noell in the Air Force. The German pathologist Oberfeldarzt Professor Schurmann (who was killed in action) is credited with having worked out this system of utilizing existing scientific institutions by infiltrating them with military personnel, and leaving the former civilian directors in charge. Additional personnel on short or long assignments was added from the Army and Air Force. In 1940 the medical-scientific personnel of the Institute numbered 16, of whom 14 were members of the permanent staff. Three of these worked for the Luftwaffe, 5 for the Army, and 6 continued their civilian projects. There was a gradual growth until 1943, when the total medical-professional personnel numbered 26 (16 of them permanent staff members); of these 10 were Air Force personnel, 6 Army personnel, and 10 civilians. From 1943 on, personnel diminished again. The names represented in this turnover of personnel are listed in Appendix 1. ,There was, in addition, a large technical and secretarial staff, some of whom were supplied by the Army and Air Force. The total annual expenditure, including salaries, amounted to 300,000 Reichsmarks, most of which came from the origin endowment of the Institute (275,000 Reichsmark per annum). These figures do not include the personnel and the expenditures of the genetic section, the administration of which was separate from the rest of the Institute.

The brain of any member of the Luftwaffe, on whom an autopsy was performed, or who was killed from whatever cause with the exception of anoxia,

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anywhere within the jurisdiction of the German armed forces, was sent to Dr. Spatz's section, while the other organs were sent to Professor Buechner at t Pathology Institute of the University of Freiburg. The brains of those who died from anoxia were likewise sent to Buechner. This policy was carried out, of course, within the natural limitations of feasibility and convenience In actual practice, the relative number of autopsies performed in fatal casual ties and the number of brains sent for examination declined from the latter part of 1942. Similarly the brains from the Army's autopsy material were se to Dr. Hallervorden's special pathologic section, while the other organs went to the Militararztliche Akademie in Berlin. There was a policy of liaison and exchange of material and information between all these echelons, which in practice, however, existed only on a very limited scale.

1. The anatomical and general pathology section of Dr. Hugo Spatz, of the Kaiser Wilhelm Institut fur Hirnforschung.

The present staff of Dr. Spatz, in addition to a small technical and secretarial staff, consists of two of his associates, Dr. R. Lindenberg, Stabsarzt der Luftwaffe, and Dr. Link, likewise Stabsarzt der Luftwaffe. Dr. Spatz and his associates were very cooperative in giving information and in demonstrating the material in their possession. During the war Dr. Spatz and his associates studied 3,338 brains from Luftwaffe sources; 1,982 were c sed blunt injuries, 1,356 open wounds, such as gunshot wounds and wounds from high explosive missiles. While all were carefully studied and describe in the gross, not all were studied microscopically. Nevertheless the microscopic study of a considerable number has been completed. Part of the remaining gross material was not evacuated to Munich but remained in Berlin. Dr. Spatz not only discussed and demonstrated his findings in detail, but also placed at my disposal a collection of reprints and a complete index, arrange according to subject matter, of his own publications and those of his assoc as well as unpublished summaries of the results of his studies and research. which had been submitted to the Air Force authorities and a set of

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representative illustrated protocols . The unpublished papers include the following typewritten manuscripts :-

(1) "Prinzip der Organization der Forschungsarbeiten am Kaiser Wilhelm Institut fur Hirnforschung, Berlin-Buch, waehrend des Krieges".

(2) "Pathologische Anatomie der gedeckten und offenen Gehirnverletzungen, 17-5-1944. Richtlinien. Oberfeldarzt Prof. Spatz.

(3) "Vortrag auf der Arbeitstagung der Beratenden Arzte, 17.5.1944: Die pathologische Anatomie der gedeckten und offenen Hirnverletzungen". Von Oberfeldarzt Prof. Spatz.

(4) "Im Gehirn liegt die Fuehrung: 30 Jahre Kaiser-Wilhelm Institut fur Hirnforschung", von Professor H. Spatz, Direktor des Kaiser Wilhelm Institutes fur Hirnforschung.

(5) "Aus dem Gebiete der Gehirnpathologie mit besonderer Berucksichtigung der Luftfahrtmedizinischen Belange. Fur die Festschrift fur den Chef des Wehrmachtsanitaetswesens, 22.9.1944, Oberfeldarzt Prof. Spatz.

(6) "Von dem Zielen des Kaiser Wielhelm Institutes fur Hirnforschung, Berlin-Buch, Denkschrift an die Generalverwaltung der Kaiser Wilhelm Gesellschaft".

Microfilms of these papers will be turned over to the C.I.O.S. secretariat.

Of the findings obtained by Dr. Spatz and his collaborators, the following are of interest:

The group of <u>closed blunt injuries</u> are characterized by a relatively low velocity

the skull. Carefull study of the location of the centre-coup infuries thus produced showed that they involved particularly those parts of the brain which were near the bone and poorly covered by the spinal fluid cushion, i.e. especially the basal parts of the brain.

From these findings Dr. Spatz (Appendix 2, No.1, and unpublished material) and his co-workers concluded that in these types of injury the impact probably displaced spinal fluid underlying these areas. It was felt

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that this spinal fluid could only be displaced toward and through the foramen magnum. They further concluded that this displacement of spinal fluid on its way to the foramen magnum produces a compression wave which in passing exerts pressure on the brain stem. Dr Spatz and his group accept this chain of even as the probable cause of the symptom complex commonly known as "cerebral concussion" or "commotio cerebri". This compression wave usually leaves no anatomical traces in the brain stem, but may cause some disturbances due to traceless changes ("spurlose Vorgaenge"). Duret's haemorrhages were not constantly observed.

Dr. Spatz stressed that fact that in cases of post-traumatic syndrome "brain stem symptoms" frequently manifest themselves clinically, without demonstrable brain stem lesions being found at autopsy. To him this fact emphasises the existence and importance of traceless events in the brain caused by trauma, ("spurlose Vorgaenge"), that is, changes for which no anatomical substratum has yet been found with present day methods.

Stress is laid on the frequency of lesions at the basal aspect of the cerebral hemispheres, particularly of the orbital part of the frontal lobes following such blunt injuries. One of his co-workers, Welte, found remnants of basal contusion of the brain in 2½ % of 2,000 cases derived from consecutive autopsy material of a civilian neuropsychiatric hospital. Such old infuries was occasionally found as accidental findings in flying personnel, and may have to be considered as a possible cause of aircraft accidents, such as for instance, in a pilot who died from severe internal infuries after his aircraft suddently crashed from 100 metres altitude for unexplained reason. In this case extensive cortical scars at the basal surface of the left temporal lobe were found (Figs 1a and 1b). These scars were sustained in an automobil accident three years earlier, which had caused obvious distrubance of only 6 weeks duration.

The group of open penetrating injuries are characterized by the fact that they were inflicted by high speed missiles of sharp cutting or shattering

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type, which acted with relatively great velocity upon a relatively small plane of impact. Thus an intense impact is exerted upon a relatively small area. For this reason the damage usually remains localised and is not transmitted to any large extent, so thatcontrecoup injuries do not usually occur in this type of injury.

The injuries produced by blunt force were roughly divided into 6 group depending upon the location from which the blunt force originated: 1. from behind, 2. from the front, 3. from the left, 4. from the right, 5. from above, 6. from below. By grouping these injuries according to these categories, it was found that the distribution frequency differed from that of injuries suffered in times of peace. While in peace most head injuries from blunt force are inflicted from behind, and only 5% from the front, in wartime Luftwaffe material 75% of the injuries were inflicted fromthe front, because of the crash of the head against the aircraft instrument-board in accidents. Consequently basal orbital lesions are more frequent in this material. These lesions, although causing no pathological neurological signs and symptoms apart from olfactory disorders, are bound to give rise to personality disorders of the orbito-frontal type. Dr. Spatz said that Dr. Toennis, the neurosurgeon, had a clinical material, amounting to several hundred cases, with character changes produced by bilateral frontal injuries. The various morphologic types of lesions caused by these injuries from the front were specially reviewed by Peters (Appendix 2, No. 5).

In blunt closed injuries from the right the contrecoup injuries are usually on the left; therefore organic symptoms especially those referable to the speech areas are more frequent in this group than in the group of blunt closed injuries from the left. The lesions in the group of injuries sustained from above are similar to those from behind. In the group of injuries sustained from below, cerebral cortical contusions are very rare, because the convexity of the brain, which is the site of the contrecoup impact in this type of injury, is amply cushioned by spinal fluid.

As to the histopathologic development of the lesions, both in the closed and open groups, the haemorrhages were considered to have developed

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immediately under the influence of the impact itself, and are not regarded as in any way necessarily connected with subsequent vascular disturbances such as had been assumed by Ricker. However, it was found that underlying the original direct lesion, within 2 days after the trauma wedge-shaped areas of additional necrosis develop. Peters (Appendix 2, No. 6), was able to reproduce similar areas in animal experiments. Spatz and his co-workers do not consider even these as wholly due to vascular disturbances, but likewise in part to a mechanical factor, which Hallervorden described as "Thixotropie" (Zbl. Neurochirurgie, 6:37 - 42, 1941). Hallervorden, and likewise Spatz and his group, feel that the blow causes an immediate alteration of the state of the protoplasm in these areas, comparable to the liquefaction of gels. Owing to irreversible alteration of the state of the protoplasm, this focus of contusion then gradually degenerates. Its wedge-shaped form is explained entirely by mechanical factors associated with the convolutional pattern of the brain since it is of different shape in the brain of lissencephalic animals. It is regarded as important that the area of accessory necrosis caused by the blow is not outlined until two days have elapsed, because in open injuries this area of additional necrosis may become a source of infection.

In studies of the final results of the traumatic lesions, the following topographic and morphologic characteristics were regarded as indicative of the traumatic origin of a given lesion:

1. The location of the lesion at the summit of the convolution, while the valleys are spared.

2. The wedge-shaped form of the underlying accessory necrosis.

3. In large foci concrescence with the meninges.

Among the traumatic brain changes encountered in this material, one new group stands out; it is characterized by extensive brain tears caused by bone splinters ("Hirnzerreissung", Peters Appendix 2, No. 5), which are characterized by the curious fact that they never bleed. This was illustrated to me by an instructive case of a 19-year old enlisted man who died in an aircraft crash. There were extensive fractures of the skull, especially of the base (Figs 2a and 2b), and while there were extensive subarachnoid haemorrhages

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(Figs 2c) and punctate haemorrhages within the basal ganglia and the temporal lobes (Figs 3), no haemorrhages were seen within the extensive traumatic lesions caused by the bone slinters at the base of the frontal lobes (Figs 4). Spatz and his co-workers stated that they convinced themselves that these tear occured ante mortem. One of the collaborators Kruecke, in a paper in press at present (Appendix 2, No. 21), found fat embolism of the lungs in 31% of fatalities due to aviation accidents, and fat embolism of the brain in 25%.

Unilateral oedema of the brain, a complication, particularly, of open head injuries with infection or haemorrhage, was found to express its presence clinically by dilatation of the homolateral pupil (mydriasis). (E. Welte, Appendix 2, No. 11), which was found to be due to compression of the homolateraloculomotor nerve by the swollen uncus hippocampi. Figs 5, 6 & 7 illustrate this fact in a representative case of a soldier injured by a shell fragment in the right parietal area, (Figs.5)which caused depression of bone fragments and severe haemorrhage into the right parietal lobe (Fig. 6), There was no prolapse because the opening of the skull was obliterated by impacted bone fragments; but marked oedema of the right hemisphere developed (Fig. 6), which is seen to flatten and compress the right oculomotor nerve. (Fig.7). The soldier died on the sixth day following the injury. Clinically, there were motor aphasia and marked dilatation of the right pupil, later increasing drowsiness and slight stiffness of the neck. His right leg had to be amputated because of an additional injury.

In 75% of those patients who died from penetrating wounds of the skull, meningitis was found. Noetzel (Appendix 2, No. 8), states that this figure is identical with that obtained in representative samples during the last war, which varied between 70% - 80%. He adds that during the last war 54.7% of all cases of penetrating wounds of the brain developed meningitis, with death resulting in 37.7%. According to figures given by Toennis (see report on German military neuropsychiatry and neurosurgery) in this war only 15% developed meningitis, causing death in 12%. Noetzel (Appendix 2, No. 10), also studied the extension of superficial inflammatory lesions into the brain,

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(abscesses, encephalomyelitis, pyocephalus internus) in human traumatic material as well as in experimental material in animals. A special study of 400 cases revealed that ventricular infection was frequently secondary to the surgical intervention. In 50% of his meningitis cases, Noetzel found subdural empyema which was found to be secondary to subdural haemorrhage (Appendix 2, No. 9). In a number of cases these subdural empyemas were of extremely large size (Fig. 8).

The problem of subdural haemotoma was reinvestigated by Link, who made a valiant though unconvincing effort to differentiate between traumatic subdural haematoma and presumably non-traumatic pachymeningitis haemorrhagica interna in 1,000 cases.

On the whole a close liaison with Dr. Toennis' neurosurgical organization was professor of neurosurgery at the University of Berlin before the war, was also a part-time member of the Kaiser Wilhelm institute fur Hirnforschung, as director of its research sub-department on brain tumors, and experimental pathology of the brain. During the war this collaboration was extended to Toennis neurosurgical organization within the Air Force Medical Corps.

The availability of histologic material derived from closed and open injuries of the brain was also utilized for still unpublished studies on the differences between the symptomatic type of inflammation which occurs as a reaction to closed unjuries of the brain, and the true infectious inflammation which occurs in open infected injuries of the brain.

The traumatic meningitides were also compared with a series of odontogenic meningoencephalitides (Lepp, Appendix 2, No. 12). The problems of oedema and increased intracranial pressure were studied in a series of morphohistologic and physical-chemical studies (Zuelch, Appendix 2, No. 14; Perret, Appendix 4, No. 10; Selbach, Appendix 4, No. 12; and Perret & Selbach Appendix 4, No. 11).

In addition to these studies in connection with war problems, studies concerning civilian problems were carried on. Dr. Spatz himself published a review of the histopathologic findings in mental diseases (Appendix 3,

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No. 14). He and a co-worker continued research on the system atrophies of the brain, especially Pick's atrophy (K.v.Bagh, Appendix 3, No. 13; see also H.Spatz: "Uber die Systematrophien und die Picksch Krankheit im Rahmen dieser Gruppe", Gegenwartsprobleme der psychiatrich - neurologischen Forschung, C.H. Roggenbau, Ed., Berlin 1938). In addition, there were investigations of encephalitis problems as well as other types of paralysis agitans and the Parkinsonian group of illnesses (Klaue, Appendix 3, No. 12), and a new group of illnesses on the border line between inflammation and tumor formations, (Blastom - Encephalitis and ependymitis blastomatosa), as well as a group of related gliomata (Schoepe, Appendix 3, No. 8, T. Hazenjaeger, Appendix 3, Nos. 6 and 7).

Abnormalities and changes of the carotid arteries, estecially in Buerger's disease, were studied by Dei Poli and Sucha (Appendix 3, No. 10) and by Charlotte Krucke (Appendix 3, No. 11), who made an interesting observation by finding ossified thrombi in 5 cases of thrombosis, four due to Buerger's disease. T. Luers prepared an inclusive study of the cerebral form of Buerger's disease, (Appendix 3, No. 18). Becker (Appendix 3, No. 5) carried out a study on the tissue changes produced by experimental occlusions of arteries and veins., Lange-Cosack (Appendix 3, No. 19) presented a thorough study of the clinical and anatomical findings in a case of a special form of anencephaly in which both cerebral hemispheres were reduced to thin walled vesicles, and for which she coined the term Hydranencephaly (Blasenhirn). Reproduction of this pathologic picture in experimental animals by intra-arterial paraffin injections was attempted.

Dr. Angel Pentscheff, a Bulgarian neuropsychiatrist and head of the department of psychiatry at the University of Sofia, studied cases of "Kornicterus" followed clinically by athetosis. He coined the name "Encephalopathia postictorica" for this group of cases.

Dr. Spatz and his co-workers performed a series of experiments on rabbits, aimed at finding the center regulating secual functions. They believe to have localized it in the tuber cinereum (Appendix 3, Nos. 23 and 24).

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Among these co-workers there was a Dutch neuropathologist, Dr. Diepen, who studied the normal anatomy of the hypothalamus of the rabbit. A french medical officer, Dr. Jean Grumer, who was a prisoner-of-war in Berlin, used to come to the laboratory once or twice a week for 6 - 9 months in 1944, but did not carry out any particular research work.

Dr. Spatz and his associates, all of whom had spent varying times at the various war fronts, were also questioned concerning certain general problems of neuropsychiatric interest and about the work of other members of the institute, as well as that of related specialists in other organizations.

Concerning the neurosurgical organization they stated that the directing and policy-making powers lay - for the Luftwaffe - in the hands of Dr. Toennis and for the Army in the hands of Dr. Keiper, both of whom had commissions in the Air Force and Army respectively, and that they integrated all activities extending from the front line areas to the rear. At the front the work was carried out by small neurosurgical units (Sanitaetsbereitschaften), which consisted of a chief neurosurgeon, 2-3 younger neurosurgeons, 1 neurologist, 1 ear, nose and throat surgeon, and one maxillo-facial surgeon, as well as a varying number of junior medical officers, all together usually 6 - 12 physicians in addition to nurses. These units usually functioned 50 kilometers behind the front, and received all injuries of head and spinal cord directly from the first aid stations. About 30 small planes of the Stork type were assigned to them, by which they could carry out air evacuation to the rear. However, this was frequently difficult due to shortage of gasoline and flying personnel. In the rear, the neurosurgical cases were segregated in large centers, of which Dr. Tonnis' center in Berlin, which included the Olympic Stadium as a rehabilitation center, was the largest. After the step-up of the air attacks against Berlin and the approach of the Russians, it was evacuated to Bad Ischl in Austria. Another large center was at Tutzing on the Starnberger Lake where it is still situated at present.

Electroencephalographic examinations for Army and Luftwaffe were carried out by Drs. Kornmueller and Noell, who are at present at the Physiological

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Institute of the University of Goettingen. The practical utilization of electroencephalography was found useful in the differentiation of organic and non-organic illnesses, with particular reference to the flying fitness* of air personnel following head injuries. Dr. Spatz added that Dr. Kornmuellc in addition to his other duties, also carried out confidential work on an analyzer. This was the only confidential or secret work carried out at the Kaiser-Wilhelm Institute. Administratively the Luftwaffe section of the Kaiser-Wilhelm Institute was under Luftgau 3, which was that of the 20 German Luftgaue, which included Berlin and surroundings.

In regard to Dr. Hallervorden's section, Dr. Spatz added that most of his records were taken to Schleswig-Holstein by Dr. Patzig, especially all the records on gunshot wounds of the brain in the German Army. Dr. Patzig, before the evacuation of the Kaiser-Wilhelm Institute, in charge of a military hospital for gunshot wounds of the head in Berlin-Buch. In addition to the material on brain injuries in the German army, Dr. Hallervorden, and particularly one of his assistants, Dr. Eicke, also investigated a great many brains from cases of typhus. In Dr.Spatz's opinion, it is the largest collection of brains from cases of typhus ever accumulated.

No work concerning military selectionwas carried out in the Kaiser-Wilhelm Institute. Of outstanding men responsible for selection for the Army and Luftwaffe respectively, Dr. Spatz named Oberregierungsrat Simoneit-Berlin, Dr. Wolfgang Hochheimer - Berlin, and Dr. Luxenburger, now at the Luftwaffe Hospital in Possenhofen on the Starnberger Lake.

*FOOTNOTE: Apart from flying status, the main categories of duty status in the German Army and Luftwaffe, were: k.v.i.c. kriegsverwendungsfaehig (fit for combat duty), g.v.o.r garnisonsverwendungsfaehig (fit for garrison duty) and a.v. "arbeitsverwendungsfaehig (fit for labor duty).

As to the treatment of post traumatic disorders of the brain, Dr. Spatz stressed the fact that the best results were obtained with early therapy by means of work and athletic trainings. Toennis had a particularly good set-up in regard to athletic training, competitive sports and gymnastics, since his

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hospital in Berlin-Reinickendorf included the former Olympic Stadium, with its facilities for water sports etc. Some of the experiences from Toennis's clinic were published by H. Pittrich, "Obungsbehandlung Hirnverletzter" (Zbl Neurochirurgie 7: 44-55, 1942).

As to the functional complaints, especially the neuroses, Dr. Spatz states that for therapeutic reasons the term "fatigue states" ("ueberanstrengte" was preferred. Such patients were not supposed to be ill, but merely fatigued. The leading personalities in the treatment of these functional disorders were Immo von Hattingberg and Dr. J.H. Schultz in Berlin. Dr. Spatz was impressed by a report concerning their methods of treatment which was presented at a special military medical meeting. Dr. Lehmann, of whom Spatz thinks very highly, investigated these fatigue states from the viewpoint of work physiology ("Arbeitsphysiologie"). For the Luftwaffe, Dr. Spatz named Dr. Strughold in Goettingen and Dr. Luxenburger at Possenhofen as the main authorities on this subject. Spatz stated that there was no limitation of combat tours in the Luftwaffe, and that the amount of combat flying required of any individual aviator varied individually according to the stability of his nervous system.

Dr. Spatz feels that suicides in the German armed forces were fairly frequent, and he referred to Dr. Luxenburger, who, he thought, had written a paper about it.

Dr. Spatz and his associates were then asked whether any new diseases of the central nervous system had been observed by them during the war. They denied that question, but stated that a new syndrome was observed recently in patients who died from methylalcohol poisoning (most of them liberated Russian slave-workers, who mistook stores of industrial fluid containing methyl-alcohol for a potable beverage). In those cases that survived for a sufficient length of time, a selective bilateral symmetric necrosis of the putamen was observed, frequently with haemorrhagic admixture. When Dr. Spatz demonstrated these specimens to me, they appeared reminiscent of the bilateral necrosis of the putamen found by Woods and Pendleton in patients who had eaten decomposed, partly fermented corn during a famine in China. Dr. Spatz and his associates encountered no cases of epidemic encephalitis during the

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war.

As for brains from the killing centers of the insane, Dr. Spatz denied that he or any other member of his Institute ever had received any. He added that the killing of the insane was done in deep secret, that nobody was suppose to know about it except SS personnel (although of course it did leak out), that consequently no scientists or scientific institutions could be contacted in order to undertake neuropathological studies, and that thus invaluable pathologic material was lost and remained unutilized. (This statement was later revealed to be in part inaccurate, when Dr. Hallervorden, who was a section chief right in Dr. Spatz's own institute, admitted having received and examined 500 brains from the killing centers of the insane).

As stated above, the genetics department of the Kaiser-Wilhelm Institute in Berlin-Buch had remained in book "Experimentelle Mutationsforschung in der Vererbungslehre", T.Steinkopff, Dresden & Leipzig, 1937, I-X, 1-181, is well known.

2. The Special Pathologic Section headed by Dr. J. Hallervorden, of the Kaiser Wilhelm Institute fur Hirnforschung.

Dr. Hallervorden's laboratory was visited on 14 and 15 June 1945. The laboratory was found remarkably well equipped and in full activity despite its improvised quarters. The success of the improvisation was apparently due to the fact that it was evacuated early in May 1944 because of the air bombardment of Berlin. The vast bulk of the extensive collections of histopathologic preparations, including the late Dr. Bielschowsky's collection had been brought here without mishap and are easily accessible in well ordered collection cases. The entire set-up was reminiscent of the original Kaiser-Wilhelm Institute in the Magdeburgerstrasse, Berlin, Before it was removed to the sumptuous quarters in Buch. The collection consists of more than 110,000 specimens derived from 2,800 cases, in addition to several thousand specimens from the State Hospital in Goerden, Dr. Hallervorden's previous location where he was succeeded by his pupil, Dr. Eicke, in addition to uncounted military cases, consisting mainly of gunshot wounds, cases of typhus,

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poliomyelitis etc. which had been collected since 1939. As stated above, Dr. Hallervorden's laboratory was integrated into the army as the "Sonderstelle zur Erforschung der Kriegsschaeden des Zentralnervensystems", and from 1939-1943, Dr. Hallervorden held a position as civilian consultant of the army (Sonderfuehrer) with an assimilated rank of 1st Lieutenant, under the military command of Oberfeldarzt Patzig who headed the army organization at the Kaiser-Wilhelm Institut. While Dr. Hallervorden has an ample technical and secretarial staff at his disposal in Dillenberg, only one of his professional associates has remained, namely Dr. Charlotte Kruecke (Dr. Wilhelm Kruecke's wife). His two other associates, Dr. Hugo Noetzel, Stabsarzt der Luftwaffe, and Dr. Eduard Wolte, Oberarzt der Luftwaffe, were arrested as prisoners of war on 4 April 1945. Dr. Hallervorden was very cooperative in discussing all his findings, demonstrating his superb histological preparations under the microscope, and turningover a complete bibliography of all papers published from his section by himself and his collaborators. Copies of special reports which he made to the army medical authorities covering the years 1940-1941, and 1941-1942, and carbon copies of 5 unpublished papers were placed at my disposal.

Dr. Hallervorden and his co-workers have carried out a great deal of research during the war and he has kept up his high standards as a thorough accurate and ingenious observer. His publications and those of his co-workers, listed in Appendix 5, cover a wide range of highly interesting neuropathologi subject matter, namely: the late changes produced by cerebral oedema (Appendix 5, No. 1), circulatory disturbances as the cause of congenital mental deficiencies (Appendix 5, No. 2), the central demyolinizing diseases (Appendix 5, No.4) athetosis and paraballism (Appendix 5, No. 5), the mucoid degeneration of peripheral nerves (Appendix 5, No. 6), intracerebral calcifications and Sturge-Weber's disease (Appendix 5, No.7), histopathologic sequelae of subarachnoid haemorrhage (Appendix 5, No. 8), microcephaly in twins (Appendix 5, No. 9), Hallervorden-Spatz' disease (Appendix 5, No. 10), myoclonus epilepsy (Appendix 5, No. 11), the cerebral changes subsequent to attempted

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strangulation (Appendix 5, No. 12), the above mentioned problem of "Thixotropic" (Appendix 5, No. 13), chronic Progressive Chorea (Appendix 5, No. 14), Wilson-Pseudosclerosis without cirrhosis of the liver (Appendix 5, No.15), paramyloidosis of the brain (Appendix 5, No. 16), oedema and serous inflammation of peripheral nerves (Appendix 5, No. 17), histopathology of neural muscular atrophy and its relationship to hypertrophic neuritis and neurofibromatosis (Appendix 5, No. 18), cerebral changes caused by Trichinosis (Appendix 5, No. 19), on the pathologic changes of the central nervous system in typhus (Appendix 5, No. 20), on the special pathology of the substantia nigra (Appendix 5 No. 21), on the general problems of encephalitis and polyneuritis (Appendix 5, No. 23), and on fetal encephalomeningitis (Appendix 5, No. 24). The latter was based on the study of two twin fetuses, who died two hours after their premature birth during the seventh month of pregnancy. The brains - which had originally been removed in order to complete an embryologic collection - showed disseminated encephalitic changes. The mother, who at one time had had a gonorrheal infection suffered from no known illnesses during her pregnancy apart from several mild attacks of sore throat.

Of particular interest are Dr. Hallervorden's annual reports. Because of their length they are not included in the appendices to this report, but they will be available as microfilms through the C.I.O.S. secretariat. In the report of 1940-1941, Dr. Hallervorden discusses his findings in typhus, on the whole along the lines of his published paper (Appendix 5, No. 20). Among other infectious illnesses he mentioned a peculiar illness which he found in a French prisoner-of-war, who, in the course of an illness lasting three weeks, suffered paralysis of all extremities and became somnolent. After his death, degeneration of the entire anterolateral tract of the spinal cord and of the anterior roots was found, but the grey matter of the spinal cord and the posterior columns had remained intact. The brain showed marked protoplasmic glial proliferations and lymphocytic infiltrations throughout the parenchyma, as well as lymphocytic infiltration of the meninges. Another case is an astrocytoma of the medulla oblongata. Another case is an

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astrocytoma of the medulla oblongata. Another interesting case is one of thrombosis of the left carotid artery which occurred in an arteriosclerotic individual who had died presumably of fright during an air raid alarm. Two other cases are sudden deaths during physical exercise, one while carrying out punitive drill, another during a march with full pack. The former had been inoculated against typhus the day before, and on autopsy showed unilateral edema of the brain. The latter showed mild perivascular infiltrations about the intracerebral blood vessels and signs of chronic meningitis.

Of particular interest was the examination of scars of peripheral nerves, which revealed amongst degenerative changes, two new types of findings, namely: a peculiar mucoid degeneration, and in older scars peculiar vascular changes which were reminiscent of those found in neural muscular atrophy, hypertrophic neuritis and von Recklinghausen's disease.

The total number of specimens studied during the year was 679. This includes 247 biopsies from brain tumors obtained as brain cylinders from punctures.

The report for 1941 - 1942 includes a detailed report of three cases of African sleeping sickness (trypanosomiasis), in two negroes from southern France, and one German soldier. The latter had never been to tropical Africa. He was an aviator, aged 32, who had been stationed in France. Dr. Hallervorde points out interesting differences between trypanosomiasis and dementia paralytica, which otherwise are histopathologically very similar. These differences are mainly, that in trypanosomiasis the involvement of the white substance of the brain is more marked than the involvement of the cortex, while the reverse is the case in dementia paralytica; and that among the enormous infiltrations in trypanosomiasis plasma cells are far in excess of other infiltrative cells. The clinical history of the third case, the German aviator, is interesting in that the disease, which began with a convulsive seizure followed by temporary hemiplegia, was first diagnosed as hysteria, then as brain tumor. He died a few days after his clinical picture changed

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into a state of somnolence with rigid gaze, bulbar speech and Parkinsonian rigidity. The latter was explained by the intensive involvement of the brain stem, the pons and the medulla oblongata found on neurohistologic examination.

Another case brought up the problem of differential diagnosis between disseminated encephalomyelitis and poliomyelitis.

A curious case is one in which the brain of a patient who died from endocarditis showed, in addition to small abscesses and softenings, another single lesion which exhibited all the characteristics of a focus of multiple sclerosis. Careful search of the brain revealed no other similar focus. In view of his rejection of the vascular theory of multiple sclerosis, Dr. Hallervorden comes to the conclusion that this must have been a rare case of a single isolated lesion of "multiple sclerosis", this postulating that two diseases co-existed in this patient.

In 30 cases of tetanus, of which studies of 14 only were fully completed only one case with morphologic abnormalities of the brain, consisting of slight lymphocytic meningitis was found. In four cases, the peripheral nerves showed slight neuritic changes. In 11 cases of arsphenamine reaction, the usual oedema and punctate haemorrhages were seen. Dr. Hallervorden pointed out the differences in this type of reaction from those found in genuine encephalitis.

180 cases of blunt cranio-cerebral injury were studied. These cases were divided into four groups: those in which death occurred within the first two hours; those in which death occurred between 2 - 5 hours; those in which death occured between 5 - 36 hours, and those in which death occurred after 36 hours. It was found especially in the 36-hours and 3-day groups that the degree of tissue reaction found in different cases of identical duration varied a great deal. When these differences were correlated with the general state of the patient, it was found that the tissue reactions were less marked in those cases inwhich there was the most severe degree of shock, especially associated with fat embolism of the lungs, multiple fractures, rupture of the liver with intra-abdominal haemorrhages, or with marked blood loss of

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other etiology. The conclusion was arrived at that the intensity of tissue reaction on the part of glial and mesodermal elements in the brain depended upon the general phusical condition of the patient.

226 cases of gunshot wounds of the brain were examined. These cases were likewise divided into four groups: those in which death occurreddduring the first two hours; those in which death occurred between 2 - 12 hours; those in which death occurred between 12 hours and 5 days, and those in which death occurred between 5 days and 31 months. The first and second groups included those which there was the most intensive destruction of brain substance, and in which the destruction of brain substance and its immediate after-effects were the main cause of death. Meningitis as cause of death appears in the third group, and abscesses were already observed on the fourth day. The first necroses were found 14 hours, and the first softening two days after the injury. In the fourth group, meningitis predominates as the cause of death. Only in two cases, were prolapse and cerebral oedema without meningitis fatal. Other causes of death were subdural haemorrhage, internal haemocephalus, etc.

Among the 52 open penetrating lesions of the spinal cord encountered among 98 cases of spinal cord lesions examined, only 50% showed histological ecidence of infection. Dr. Hallervorden regards this finding as interesting because it contrasts with his experience in open lesions of the brain, in almost all of which there was histologic evidence of infection, and in the vast majority was the cause of death.

Furthermore, 118 cases of meningitis, 17 cases of gas infection, 11 cases of carbon monoxide poisoning, and 58 cases of brain tumors, were examined.

At the end of his report Dr. Hallervorden makes the observation that while pathological material of the nervous system was supposed to have been sent to him from all army pathological services, he noted that in actuality, only certain army groups availed themselves of his services, while other armies did not. Thus his material is representative of that encountered in certain armies only, of which he named the 6th, 17th and 2nd.

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Dr Hallervorden demonstrated microscopic preparations of his recent work to me, and discussed them with me. He stated that he had examined a total of 300 brains of patients who died from typhus. 200 of these came from the Jewish hospital in Warsaw. On the whole, he confirmed Spielmeyer's findings on the cerebral changes in this condition. The cortical degenerative changes found were early ones, "rather in the stage in which they can be predicted than at the stage in which they are fully developed". His material included no cases in which real softening of the brain had occurred. Neither did his cases include any that had shown clinical signs of Parkinsonian type during life; although he has never seen brains from such cases, he considers them as probably due to vascular changes. The changes which Dr. Hallervorden saw in his brains consisted of the well known perivascular nodules, sometimes with necrotic center, which he interpreted as possible reactions to diapedesis of blood and [illegible] cases of fat embolism in the white substance. In typhus, however, they occur in the grey matter exclusively. After the patient recovers from the disease these small granulomas disappear without leaving a trace, not even a glial scar. One exceptional recovered case showed a connective tissue scar. However, Dr. Hallervorden re-emphasized that no cases with neurologic residuals (especially Parkinsonian residuals) had come to histological examination. He denied that he ever received cases from concentration camps. Dr. Hallervorden at present has only the histological sections at his disposal. The gross specimens of the brains have remained in Berlin-Buch.

One of his collaborators, W. Velland, attempted to solve the question whether the parainfectious (perivenous) encephalitides are due to virus infection or due to allergic reaction. By comparing the findings in these encephalitides with those in known allergic reactions Velland, and Hallervorden himself, who supervised his work, came to the conclusion that their causation by direct virus infection is more likely. Publication of the paper was bloocke by the German army because vaccinal encephalitis had been mentioned in the title. The paper had been completed on 26.4.1944 (Appendix 5, No.28). A

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microfilm reproduction of the summary of this paper will be available through the C.I.O.S. secretariat.

In a study by H.J. Eicke (Appendix 5, No. 29), meningitis was found to be the cause of the destructive brain damage in 76% of 50 consecutive cases of early infantile degenerative cerebral illnesses, only the minority of which had given a clinical history of meningitis. A summary of this paper is likewise available in microfilm.

Two cases of a special type of pseudotumor, which was revealed histologically as an infectious granuloma and named "Blastomencephalitis" (Hallervorden, Appendix 5, No. 26) were studied. The first occurred in the course of an unexplained infectious disease, the second in a case of sinusitis. When I examined the preparations, it occurred to me that the distribution and certain aspects of the histopathologic nature of the lesions were similar to Eastern equine encephalitis, with similar topographic predilection of the pons.

Dr. Hallervorden had obtained 500 brains from the killing centers for the insane. These patients had been killed in various institutions with carbon monoxide gas. Dr. Hallervorden himself initiated this collaboration. As he put it: "I heard that they were going to do that, and so I went up to them and told them 'Look here now, boys, if you are going to kill all these people, at least take the brains out so that the material could be utilized.' They asked me: 'How many can you examine?' and so I told them an unlimited number - the more the better. I gave them the fixatives, jars and boxes, and instructions for removing and fixing the brains, and then they came bringing them in like the delivery van from the furniture company. The "Gemeinnuetzige Krankentransport Gesellschaft" (the "Public Ambulance Society") brought the brains in batches of 150 - 250 at a time." The man who organized this service was Dr. Heyener, a pediatrician from Berlin, whom Dr. Hallervorden remembers as a "crazy and arrogant fellow, who talked all the time about himself". "There was wonderful material among these brains, beautiful mental defectives, mal-formations and early infantile disease. I accepted these brains of course Where they came from and how they came to me was really none of my business".

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Dr. Hallervorden went on to say "this thing was a beautiful mess". In addition to all the material he wanted, all kinds of other cases were mixed in, such as patients suffering from various types of Parkinsonism, simple depressions, involutional depressions, brain tumors, and all kinds of other illnesses, including psychopaths who had been difficult to handle. "These were selected from the various wards of the institutions according to an excessively simple and quick method. Most institutions did not have enough physicians, and what physicians there were were either too busy of did not care, and they delegated the selection to the nurses and attendants. Whoever looked sick or was otherwise a problem patient from the nurses 'or attendants' point of view, was put on a list and was transported to the killing center. The worst thing about this business was that it produced a certain brutalization of the nursing personnel. They got to simply picking out those whom they did not like, and the doctors has so many patients that they did not even, know them, and put their names on the list." Of the patients thus killed, only the brains were sent to Dr. Hallervorden; they were killed in such large numbers that autopsies of the bodies were not feasible. That, in Dr. Hallervorden's opinion, greatly reduces the scientific value of the material. The brains, however, were always well fixed and suspended in formalin, exactly according to his instructions. In looking back upon that time, Dr. Hallervorden stated that he always felt slightly nauseated when another batch arrived. He was also offered brains of schizophrenics and epileptics, but these he refused - not from moral indignation - but because he felt nothing of significance would be found in them. He thinks that the cause of psychiatry was permanently injured by these activities, and that psychiatrists have lost the respect of the German people for ever. Still there were interesting cases in this material. One was a case of a severe athetoid disorder which had developed in the child of a mother who suffered accidental carbon monoxide poisoning when she was 5 months pregnant. Autopsy of the brain of the child showed bilateral necrosis of the pallidum and microgyria of the cortex. This is the only case on record in which the characteristic

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bilateral necrosis of the pallidum was produced by carbon monoxide poisoning of a fetus. The mother herself had suffered no lasting ill-effects from the carbon monoxide poisoning. The material also included very interesting cases of microgyria and pachygyria, as well as an unusual lipoma of the corpus callosum. The most interesting cases among this material, however, were two cases of brain tumor, both of oligodendroglioma, which developed in what appears to be direct causal connection with severe cranio-cerebral trauma. One was found in a 40-year old epileptic woman who had suffered a severe head trauma at the age of 3 years. Beneath the old skull fracture and the meningeal scar which still contained cellulose fibers implanted by the trauma through the open skull fracture, and attached to them, was the oligodendroglioma. The old scar and the underlying attached tumor involved the right occipital lobe near the pole. The other case was that of a boy who suffered a severe head trauma at the age of 3 ½ years. One year later he developed petit mal attacks, later grand mal attacks. He was killed in one of the killing centers at the age of 13 years. Autopsy showed an oligodendroglioma which involved the splenium of the corpus callosum and an adjacent part of the left ammonshorn. This tumor lay underneath a meningo-glial scar, which still contained blood pigment in scavenger cells. The original injury which is supposed to have given rise to the adjacent tumor formation was obviously a contusion of that part of the brain against the adjacent falx and tentorium. A copy of the manuscript of this important paper (Hallervorden, Appendix 5 No. 25), which is still unpublished, will be available in microfilm at the C.I.O.S. secretariat. Other cases in Dr. Hallervorden-Spatz disease with involvement of the substantia nigra and the pallidum, a case of Schilder-Marzbacher's disease with calcifications that involved the blood vessels, a case with multiple oligodendrogliomata, and a number of striking cases of encephalomyelitis concentrica of which excellent stained specimens had been prepared. Dr. Hallervorden has written a new paper on the general problems of multiple and concentric sclerosis on the basis of these new cases (Appendix 5, No. 27), the full paper being available in microfilm. Other new findings include an

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atypical case of diffuse sclerosis with giant cell infiltrations, and another case of diffuse sclerosis with amyloidosis of the larger intracerebral blood vessels.

3. The Physiologic and Electroencephalographic Section headed by Dr. A.E. Kornmueller of the Kaiser Wilhelm Institut fur Hirnforschung.

Dr. Kornmueller's laboratory was visited on 16 June 1945. I prepared myself for this visit by the study of Dr. Kornmueller's recent book (Appendix 6, No. 26), which had been put at my disposal by Dr. Spatz in Munich, and by the study of two confidential reports covering the years 1940 - 1941 and 1941 - 1942, which had been submitted to the Army and Luftwaffe authorities, and copies of which I had found in Dr. Hallervorden's files; as well as of a review of the activities of the physiological and encephalographic section submitted to the army authorities by Kornmueller's collaborater, Dr. Noell, which had also been shown to me by Dr. Spatz. Copies of the book, as well as the three reports will be available in microfilm at the C.I.O.S. Secretarait

In studying the book, my particular attention was arused by a chapter on fatigue (pages 36 - 42) which describes findings which were new to me. Choppiness and discontinuity of alpha waves as well as the appearance of slow waves in the frontal lobes were regarded as characteristic in acute and in chronic states of fatigue. The remainder of the book, which is well written and well illustrated, contains findings which were in principle not new to me because similar ones had been obtained in independent studies by the leading American and Britain electroencephalographers.

The annual report 1940 - 1941 stated that the total number of electroencephalograms examined during the year was 523. Dr. Kornmueller claimed that he was able to demonstrate electroencephalographic correlates of the symptoms of fatigue and easy fatigue ability complained of by patients suffering from post-traumatic syndromes. The characteristic signs were discontinuity of alpharhythm, slow waves, and upon opening the eyes, not the usual inhibition, but activation of the alpha waves.

In closed traumatic lesions with focal symptoms, he found focally

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circumscribed areas of reduction of alpharhythm, one at the site of the original trauma, but usually a more marked one at the diagonally opposed region of the head, presumably the site of the centre coup. This was quite characteristic in patients who had suffered cerebral contusion. In cases who had suffered open injuries of the brain, the electroencephalographic abnormalities were restricted to the region of the scar and its immediate surroundings. In these cases abnormally low frequencies were most striking. Low frequencies were found generalized over the entire brain after severe injuries. In these cases in which such generalized disturbances of cerebral electroactivity were found a long time after an injury they were regarded as indicative of internal hydrocephalus or other increase of intracranial pressu

The frequent finding of slow waves over the frontal lobes in post-traumatic states was considered as being actually caused by a traumatic disturbance in the brain stem (inter-brain). This finding usually suggested an increased proneness to seizures, but it was also frequent in patients who complained about dizziness.

Causes of traumatic epilepsy were specially studied and divided into three groups: those in which the constitutional basis was paramount; those in which exogenious damage had caused a purely focal epileptogenic region at the site of the injury; and those in which there was a combination of these two factors, usually combined, in addition, with functional disorders which were presumed to be due to disturbance of the hypothalamus.

Dr. Kornmueller makes the statement in this report that he regards the electroencephalographic examination as important in the appraisal of patients in whom no other objective changes can be demonstrated, not only in cases of brain injury but also in other nervous illnesses occurring in the armed forces. Of particular interest was a series of re-examinations of patients with brain injuries which he performed together with Dr. Goetze of the Luftwaffe-Lazarett, Berlin. The following signs of improvement were found: 1. The disappearance or reduction in size of the focal areas of reduction of alpha activity; 2. the return of the slow frequencies to normal, and 3. a

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resynchronization of previously asymmetric discharges, especially in the frontal lobes. Dr. Kornmueller states that it is considered possible that electroencephalographic examination could be helpful in the differential diagnosis between cerebral contusion and cerebral concussion.

Another set of studies concerned the changes of the brain waves produced by acute severe anoxia, and he considered the possibility that the individual differences encountered in the varying resistance of the brains of different individuals against the effects of anoxia could be made into a test for the selection of flying personnel, particularly for high altitudes. Dr. Kornmueller's report ends with a practical suggestion, derived from a study in which he found that the cerebral disturbance caused by anoxia is further increased by the simultaneous lack of CO2 leading to an additional hypocapnia. Based on this observation, Dr. Kornmueller makes the suggestion that at high altitudes not pure oxygen, but $O_2 - CO_2$ mixtures should be administered.

The report of 1941-1942 stated that during that year a total of 747 electroencephalographic examinations had been made, and that the electroencephalographic examinations of patients was utilized for diagnosis and for the evaluation of the duty status of patients. With regard to his findings concerning fatigue-states, Dr. Kornmueller was more outspoken than he had been the previous year. He stated that patients suffering from post traumatic states, and also other patients with certain "vegetative disturbances" without previous trauma, usually presented a characteristic electroencephalographic picture. This picture consisted firstly in symmetric slow waves over the anterior parts of the brain. Furthermore, such cases were characterized by the fact that the disturbances caused by brief hyperventilation outlasted the hyperventilation for some time. Dr. Kornmueller added, that he has made therapeutic trials with inhalation of CO_2 in these patients. Dr. Kornmueller came to the following definite conclusion: "The fatigue states which occur frequently following head trauma, as well as the fatigue states and over-fatigue states of aviators (flying fatigue) are characterized by well defined electroencephalographic findings."

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In certain cases following head trauma, Kornmueller found abnormal discharges similar to those in epilepsy which were interpreted as an incipient increased proneness to seizures, and an indicative sign of developing traumatic epilepsy. A special chapter in the report dealt with the "paradoxical effect of oxygen administration", a phenomenon occurring in certain predisposed individuals, on which studies were later published by Noell, Kornmueller, Gremmler, Schneider and Roeder, (Appendix 6, No. 20; Appendix 7, No. 1; Appendix 7, No. 8). Independently, during the war, this "paradoxical effect" had been observed also by American and British experts and designated "recovery effect". (I do feel, however, that the name "paradoxical effect of oxygen re-administration" is better and should be adopted).

Dr. Noell's report :"Uberden Einsatz der hirnelektrischen Untersuchungsmethode in der Luftfahrtmedizin, Festschrift fur den Chef des Wehrmachtsanitaetswesens", Dr. Noell states that electroencephalography is a valuable aid in the examination of patients who have suffered injuries of the brain, and for the appraisal of fitness after head injury or after states of exhaustion, especially if subjective complaints persist in spite of the fact that abnormal neurological findings are absent or slight. Electroencephalographic examination can "objectivize" these complaints, and can furthermore allow an estimate as to the degree of damage. In addition, electroencephalographic examination may uncover a focal injury, especially at the site of contrecoup, which, in view of the widespread presence of mute zones in the brain, cannot be done by clinical neurological examination, at least not with any degree of certainty. Electroencephalographic examination may also uncover an epileptogenic focus or at least a focus of increased seizure proneness for which the term "pre-epileptic focus" is being used. Furthermore, the report goes on to say that in most cases of fatigue state and "vegetative crisis", the electroencephalogram usually shows definite changes. Dr. Noell feels that even the degree of fatiguability can be determined by special tests in conjunction with the electroencephalogram. Further uses of the electroencephalogram include the localization of brain tumors, and clarification of the

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action of anoxia, CO_2, and changes in temperature upon the brain. Anoxia is defined electroencephalographically as a state of increased irritability with a simultaneous decrease of certain rhythmic activities. The final state of paralysis produced by anoxia is associated with an increased labilit of those elements which still react; this is the convulsive stage. The opposite changes are produced by an increase of CO_2. A decrease in CO_2, however, for instance by hyperventilation, causes changes similar to those of anoxia. Lowering of body temperature causes a characteristic state of excitation of the cortex with increased proneness to seizure, similar to that produced by certain convulsive poisons, for instance eserin and strychnine (see also C.I.O.S. report on "Treatment of shock from prolonged exposure to cold, especially in water", which includes an interview with Dr. Noell on this subject), which includes an interview with Dr. Noell on this subject), but unlike the electroencephalographic pictures in anaesthesia, as may have been expected from the clinical appearance. This is probably the reason for the contraindication of analeptics in shock from exposure to cold. In hyperthermia, on the other hand, the electroencephalographic pictur is similar to that of anoxia.

In a special study of the effects of anoxia upon the various echelons of the optic system, it was found that the cells of the retina were much more resistant to anoxia than any other parts of the optic system. Some of these differences in resistance to anoxia were considered as due to differences in capillarization. The importance of the circulation apart from its oxygen supply was illustrated by experiments which tested the effects of anoxia with and without interruption of circulation. It was found that if the circulation is interrupted completely for 18 - 20 minutes, recovery of the brain becomes impossible, while a marked degree of recovery takes place within a few hours if the interruption of circulation is only of 3 - 4 minutes duration. If anoxia, however, is produced without simultaneous interference with circulation (as for instance by local cyanide intoxication), these periods are significantly longer: recovery becomes impossible only after 40 - 60

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minutes of anoxia without interruption of circulation. Noell feels that if anoxia leads to actual collapse from mountain sickness, additional damage is caused by the disturbance of circulation incidental to such collapses.

On my visit to the laboratory, Dr. A.E. Kornmueller, who holds the rank of Stabsarzt in the Army, and his associate Dr. W. Noell, who holds the rank of Oberazt in the Luftwaffe, were very cooperative in discussing and demontrating their findings, opening their files for inspection, and showing a very instructive teaching film. Their published papers deal with the following subjects:

Epilepsy (Appendix 6, No. 11 & No. 17); anoxia and altitude sickness (Appendix 6, No. 15, 18 and 24); the action of CO_2 (Appendix 6, Nos. 19 and 23); the paradoxical effect of oxygen administration (Appendix 6 No. 20, and Appendix 7, Nos. 1 & 7); a general review of the interpretation of electroencephalography (Appendix 6, No. 21); on pre-epileptic signs in the electro-encephalogram (Appendix 6, No. 22), and on the influence of CO_2 upon the effects of anoxia (Appendix 6, No. 25). The post-hypoxemic proneness of the heart to fibrillation was studied by Noell & Schneider (Appendix 7, No. 9), and the inter-relationships between hypoxemia, the epileptic seizure and the convulsions of high altitude were studied by Gremmler (Appendix 8, No. 7). An interesting series on cerebral blood-flow under the various conditions of anoxia, hypoxia, lowering of blood pressure, CO_2 etc. has been contributed by Noell and his collaborators (Appendix 7, Nos. 2, 3, 4, 5, 6, 10, 11 & 12). All these papers will be available in microfilm at the C.I.O.S. Secretariat.

The routnie work of Dr. Kornmueller and his collaborators during the war has consisted in carrying out electroencephalographic examinations for military hospitals ("Lazarett") of all parts of the armed forces, and for "Sichtungsstellen fur erkranktes fliegendes Personal" (examination centers for sick flying personnel), especially that at Halle-Doelau. Furthermore, Dr. Kornmueller was a staff member of the "Aussenstelle fur Gehirnforschung (Professor Spatz) of the Luftfahrtmedizinisches Forschungs-Institut (Professor Strughold)". In the latter assignment he and his collaborators carried out

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experimental research. Apart from Dr. Noell, his collaborators were Dr. Joseph Grammler, Oberarzt der Luftwaffe, and until 1943 also Dr. Reinhold Gruttner, who later was assigned to Dr. Toennis' neurosurgical center. The teaching film which Drs. Kornmueller and Noell showed me was well arranged. The first section showed the usual phenomena produced by opening and closing of the eyes, hyperventilation and anoxia. The second section showed clinical examples such as narcolepsy, focal traumatic lesions and petit mal epilepsy. Colonel Wright, of USSTAF had seen the film and had been given a duplicate copy which should be available through USSTAF. A special film was shown which illustrated the "paradoxical effect of oxygen administration" (our "recovery effect"). In discussing their findings on the "paradoxical effect", Drs. Kornmueller and Noell stated that when a quick change is made from hypoxia to oxygen, about 3% of all people have a momentary seizure-like reaction, rarely with complete loss of consciousness, but with changes of tonus and some psychomotor signs of confusion of a cataplectic - narcoleptic type, which begins after EEG evidence of cerebral anoxia has passed. In some individuals similar attacks could be produced by pressure on the carotid sinus. This "paradoxical effect" is absent in those individuals if oxygen is brought back gradually. This phenomenon is obviously based on a constitutional peculiarity found only in certain persons.

The electroencephalographic effects of cold temperature were discussed then; they have already been reported in a previous report (see above).

Dr. Noell carried out special studies on survival and revival times of the brain in anoxia, as well as on the comparison of the electroencephalographic changes produced by cyanide with those produced by anoxia. All this work was done on rabbits. The papers are in press in the "Archiv fur Psychiatrie". As to the technique of measurement of the survival and revival times, Dr. Noell clamping, during which artificial respiration had been given continuously, opening of the clamps produced traces of cerebral electro - activity, this was interpreted as meaning that the survival time was 20 minutes. After 3 minutes of clamping, however, perfect revival could be obtained.

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Dr. Noell stressed that the actual functioning of the cortex in its full complexity is, of course, more sensitive than its mere cerebral electro--activity. The survival time after mere local anoxia by cyanide application with intact circulation was found to be 40 minutes. According to Dr. Noell, cyanide poisoning is equal to anoxia from the electroencephalographic point of view, except that respiration is affected earlier than cortical function in cyanide intoxication, while the reverse is true for anoxia.

Special attention was paid to the survival times of the various parts of the brain. Following clamping of all cerebral vessels no differences were found in survival times between the various echelons of the optic system, namely the quadrigemenal plate, the geniculate bodies and the area striata. However, the retina was found to survive the other parts for several minutes.

Concerning his routine work, Dr. Kornmueller stated that since 1939, five thousand clinical patients were examined electroencephalographically in his laboratory, of whom 95% were members of the Army or Air Force. In addition, he examined 1,200 normal human beings in connection with anoxia studies and other research, especially on fatigue, and on the effect of pervitin (benzedrine, amphetamine sulfate) in normal individuals. Among the patients, repeat and follow-up examinations were performed in 18%. Dr. Kornmueller had not completed his statistical survey of his findings in the military personnel that he had examined. At my request he did a spot-check statistical analysis of a random sample of 400 consecutive cases (see Table 1). It is of interest to see in this table that among the open injuries of the head the largest group of EEGs showed severe changes, while the largest group of EEGs following closed head injuries has remained normal. It is likewise interesting that 75% of the patients with neurotic complaints (which are given as constituting 4% of the intire group) had normal EEGs. This group does not include the "fatigue syndromes". The electroencephalographic "fatigue picture" ("Ermuedungs-Bild"), is defined as consisting of "chopped" alpha rhythm, and of associated 6 - 8 per second activity which disappears in

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TABLE I.

Random sample of 400 cases of military personnel examined electroencephalographically at the Aussenstelle fur Gehirnforschung in Berlin-Buch by Dr. A.E. Kornmueller and his collaborators.

Clinical Problem	Electroencephalographic findings		
	Negative EEG (Normal)	Slight abnormalities in EEG.	Marked abnormalities in EEG.
Cranial trauma, closed Blunt: Concussion, Contusion Closed impression fractures 54%	4%	23%	23%
GSE (open injuries) 15%	13%	37%	50%
Tumor suspects 5%	20%	30%	50%
Epilepsy suspects 5%	5%	15%	80%
Neurotic Complaints 4%	75%	20%	5%
Fatigue syndromes 5%		"Fatigue picture", i.e. chopped alpha rhythm and 6 - 8 per sec. activity which disappears on sensory stimuli (Knocking):	
after head injury	5%	95%	-
without head injury	30%	70%	-
Other neurological and psychiatric cases 9%	not graded as to findings obtained		

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response to sensory stimuli (such as making a noise by knocking).

Although Dr. Kornmueller classifies the fatigue picture as a slight abnormality of the EEG, yet he feels certain that it is a significant abnormality. He went on to emphasize that he never made a clinical diagnosis on the basis of his electroencephalographic study of the patient, but merely described the phenomena as he observed them and submitted them to the clinician in charge of the case, who was to integrate the information supplied into the clinical picture as a whole. Dr. Kornmueller then placed his file of routine reports, which also included clinical summaries and follow-ups supplied to him, at my disposal for investigation and study. I came away from the study of these reports with a definite feeling that the very restraint used by Dr. Kornmueller in evaluating the clinical significance of his findings must have been confusing to the clinician, unless he happened to be an accomplished electroencephalographer himself, which, however, none of them seemed to have been. Dr. Kornmueller's reports merely described brain-wave pictures without attempting to evaluate the clinical significance of the changes described. The consequence was, as is quite obvious from the letters accompanying patients coming for re-examination at later dates, and the follow-up supplied by the clinicians on these occasions, that the medical officers in charge of the patients eagerly seized any opportunity to utilize any degree of electroencephalographic abnormality reported as a justification to dispose of the patient as a case of organic and presumably irremediable brain damage, in preference to placing him into the therapeutically and administratively troublesome category of psychoneurosis. It becomes obvious to the reader of the routine report file, that a good many obviously quite neurotic patients were simply disposed of as cases of organic brain damage, and simply reassigned to lighter duties, e.g. ground duties without any further treatment, which otherwise would have been available, particularly in Dr. Von Hattingberg's psychotherapeutic department at Halle-Dölau whence most of the patients came, simply because some abnormal 6 - 8 per second activity of their frontal lobes was found. With all

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respect to Dr. Kornmueller's wide experience, demonstration of the actual brainwave records themselves by him still left me unconvinced that the occasional and slight slow wave activity which he regarded as characteristic of the chronic fatigue states had anything to do with the clinical syndromes found in these patients, especially as Hill and others have found similar sporadic 6 - 8 per second activity to be a not infrequent constitutional abnormality, especially in young people and in individuals with psychopathic trends. This, of course, in no way detracts from the validity and significance of the appearance of a significant degree of slow wave activity which occurs in severe acute fatigue states approaching sleep, and in acute anoxia. The point which I seriously question, however, is whether an analogy between these sporadic frontal slow wave patterns and the significant diffuse slow wave activity of severe acute fatigue or anoxia can be drawn. When this point was argued with Dr. Kornmueller, he himself admitted that although he personally felt certain about the justification of this analogy, proof convincing to others may still not yet be at hand; and he again re-emphasized the point that after all he never committed himself in his reports as to the definite clinical significance of these findings. In practice, however, it is quite obvious that without actually saying so his description of the slow waves and the other aspects of the "Ermudungsbild" sufficed to make the medical officer who received the report regard the case as a purely organic problem and to prevent any further psychotherapeutic measures being brought to bear on the patient. Dr. Kornmueller turned over to me three sample reports which I considered characteristic and which I shall review briefly:

Case 1: Lt. G.S., born 1915, a fighter pilot who had flown 172 combat missions, was injured on 13 May 1940, when his plane - which had had its landing gear shot off - turned over during the crash landing. He suffered lacerations of the head and contusions of the left shoulder. He did not lose consciousness, did not vomit, but was unable to move and had pains in his chest and neck. There were haemorrhages and suffusions about the eyes corresponding to his aviator's goggles, and some discharge of blood from the

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left nostril. Spinal fluid was normal and so were X-ray examinations of the skull. The left arm remained weak for a number of weeks, the pattern of weakness being that of a radial palsy. There were no sensory changes. He was treated with lightcradle, massage and galvanic electricity which caused fairly rapid improvement of the left arm. He was transferred to a hospital near his home a month later. After a considerable period of further hospital treatment and convalescent care, under which his physical complaints improved, he began, in April 1941, to complain of increasing inability to concentrate and of disturbance of memory, although he did not feel fatigued. For this reason he was referred for electroencephalographic examination on 14 February 1942. When reporting for this examination he also complained about easy fatiguability, in addition to his inability to concentrate and loss of memory. Furthermore, he said he had become intolerant of solar heat. Now he also complained of sensory disturbance in the tips of the fingers of his left hand. The basal metabolic rate was increased by 23%. A test of circulatoty efficiency performed by letting him step 30 times on a chair (obviously a test of the type of the Schneider test), produced extrasystoles. Electroencephalographic examination showed, in addition to normal waves, a number of groups of waves of lower frequency and higher amplitude, of which each burst laster a few seconds. Hyperventilation did not increase the frequency of these abnormal discharges. On 17 April 1942, the patient was again referred for re-examination. In the meantime he had been hospitalized in a Luftwaffe hospital where he complained of constant headaches which were increased by any change of temperature, such as occurred when he left his room to go outdoors and returning to his room, by warmth, by exposure to sun rays, and by mental effort. Slight excitement, such as receiving a decoration caused dizziness, vertigo and marked pallor. Frequent change of color of the face was observed. He stated that his ability to concentrate had improved and also his memory, but that slight physical effort such as that incidental to firing an airgun or playing table tennis, caused marked tremor of knees and hands. He also complained of irritability. Electroencephalographic

examination showed exactly the same findings as before, namely groups of waves of lower frequency and increased amplitude. One the appearance of such a group of abnormal waves was synchronous with a feeling of absent-mindedness on the part of the patient. On 8 July 1942, the patient was sent for his third electroencephalographic examination, after he had been for six whole weeks at airforce rest homes in Carinthia and at the Woerher-lake, where he engaged in hunting, hiking and fishing. His headaches had improved and they were now only elicitable by prolonged sejourn in the sun. He still sweated easily remained as reported before. After further hospital treatment he was referred again on 9 November 1942. His head-aches had become rare, and normal mental activity tended to bring them on much more rarely than previously. However, headaches could still be produced when he was suddenly startled or frightened. In spite of that he expressed his belief that he was ready to return to combat flying duty; but he added than whenever he flew, even at low or medium altitudes, headaches would appear. He stated that he felt a rather constant thirst. There was still marked vasolability of the face. He still seemed somewhat forgetful, and kept notes on everything he wanted to do. He felt very well as long as he did not have to do things outdoors. He could still hardly stand the sun or heat. He had become a bit more sensitive and moody then he used to be. The brainwaves at this fourth examination showed essentially the same findings as before. Brain waves of "lowered frequency" were found, "although perhaps somewhat less frequently and less definitely than before". They were regarded as "the expression of a general (vegetative?) disturbance". The control of his vegetative disturbances by Bellergal was recommended. Following this examination the patient was given a ground job. When he was re-examined on 15 February 1943, he had been doing well on ground duty, although he felt somewhat fatigued and had to put in extra rest periods. His memory had improved. He stated that when he flew in an airplane as a passenger on one occasion he developed headaches, and that at night he became easily startled and frightened when he heard the telephone ring anywhere in the building, which regularly produced an intense

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stabbing sensation in the head which caused a severe generalized headache for the next 5 - 10 minutes. His irritability was improved. The electroencephalographic findings were similar to those obtained at the previous examinations, except that this time hyperventilation caused a ready and persistent increase of the abnormal wave patterns. Immediately after a burst of abnormal patterns the patient said when asked how he felt "I just felt like dropping off to sleep". The report concluded that there was electroencephalographic evidence of brief states of reduced clarity of consciousness. The patient who had been in the meantime promoted to the rank of Captain stayed on ground duty. The patient was examined for the sixth time on 17 November 1943. His complaints had greatly improved, the only residual complaint being easy fatigueability. This time the electroencephalogram showed only occasional waves of lowered frequency which could be increased slightly by hyperventilation. Dr. Kornmueller concluded that "the findings at this examination were not as marked as before (improvement?)". The patient was sent back to his ground job.

Case 2: This patient, K.B. was a sergeant pilot who had been shot down several times in a series of very harrowing combat missions, with severe damage to his aircraft and narrow escapes. However, he never hurt his head in crashing and never suffered concussion. Since January 1943 he had occasional severe headaches on the right, especially under physical strain, long railroad journeys, etc., but no dizziness although he was easily startled and slept poorly. He lost 1½ kilos in weight, and did not respond to a period of rest at an Air Force rest home in Kitzbuhel. He sweated profusely, always had moist hands and blushed easily. He was referred for electroencephalographic examination on 29 April 1943 because of easy startle and fright reaction, headaches and sleeplessness. The headaches were more severe on the right. Neurologic examination was normal. There was no history of concussion. In this case the electroencephalogram was completely normal.

Case 3: Captain E.S. This patient had lost 30 lbs during the summer

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of 1942 in connection with a dysentery-like febrile illness complicated by jaundice. However, he continued to do duty until October 1942, when he broke down and was hospitalized. He developed disturbance of memory and concentration and whenever he became excited, a tight feeling above the eyes which sometimes spread backwards to the neck. He was easily excited, sweated profusely, and had a general feeling of uncertainty and insecurity. He gave a history of head injuries suffered in 1936 and 1937, but there had been no unconsciousness and he had not vomited. These episodes of head thrauma were not followed by significant complaints. It was considered that this patient was suffering from a slight depression which occurred after overexertion incidental to a dysentery-like illness. There was disturbance of concentration, and irritability, but physical findings were otherwise normal. The electroencephalographic report of 15 May 1943 reads as follows: "In t the anterior parts of the brain occasional waves of lowered frequency (8 - 6 per second), were observed bilaterally. On sensory stimulation sometimes no inhibition, or merely an incomplete inhibition of alpha activity occurred, such as is observed in fatigue".

There is no doubt in my mind that the correlation of these slight changes in the electroencephalogram with the clinical findings in, and the complaints of, these patients is highly doubtful, or unproven at best. Although the resulting labelling of this highly heterogeneous clinical material as "organic appears to have been eagerly seized on by the medical officers in charge of these patients because it facilitated disposition and reduced the number of cases to be included in the disliked diagnostic category of psychoneurosis, it certainly prevented utilization of such psychotherapeutic facilities as were available by those patients involved, and also made the understanding of the nature, etiology and therapy of these fatigue states difficult by introducing a variable which is not necessarily etiologically significant or rather the significance of which in connection with these fatigue statesis not proven. On the other hand, Dr. Kornmueller is a men of vast experience in electroencephalography, and while his approach to the electroencephalograp

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and while his approach to the electroencephalographic correlates of the fatigu states has not progressed beyond a certain hunch, still there may be something in it which is worth further investigation. However, even them the simple labelling of the fatigue state as organic should not be the end of the story, as was obviously the practice in the German army and Air Force hospitals, but on the contrary psychological and psychobiological factors could be operative in modifying brainwave patterns. Whatever the "fatigue pattern" in the electroencephalogram may be, it is probably not the product of an organic injury but something that is alive, changeable and modifiable, even possibly by psychologic and other therapeutic measures. This is definitely a problem for future investigation.

Dr. Kornmueller was then asked whether he had succeeded in constructing an analyzer. He replied that he had given considerable attention to this problem and had succeeded in constructing three models: Analyzer No.1. functions like a screen, a sieve, or a filter. Dr. Koenmueller calls this analyzer the "EEG filter". It filters out specific frequencies that are being sought.

Analyzer No. 2 was constructed on the principle of mechanical resonance. This analyzer signals frequencies lower then 10 per second, either by flashing a light or a knocking sound. It can be adjusted to any frequencies looked for; for instance it can signal allfrequencies lower than 8 per second, or lower than 6 or 3 per second, or any other given frequency. It does not write a spectrum; signals appear inthe form of a knock or, on the graphic recording, in form of a spike. While the principle of resonance used is similar to that employed by Gray Walter for his analyzer, Dr. Kornmueller's analyzer is dopfinitely not able to record a full spectrum of cerebral electroactivity. When these differences were discussed with him, Dr. Kornmueller appeared slightly hurt at the implication that I considered Gray Walter's analyzer superior to his, and hasted to add - "something that I originally had not intended to say because nobody else asked me about it", - namely, that the purpose of his analyzer was entirely different from that of Gray Walter. Dr. Kornmueller emphasized that he was not interested in constructing

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an analyzer that would give a complete spectrum for research pruposes, but that he was after something intensely practical that would provide a signalling machine which could signal whenever a man became inefficient either because of anoxia or because of the effects of severe acute fatigue approaching sleep, which would express itself in a significant deviation of cerebral electro-activity. Dr. Kornmueller feels that he has solved the problem of obtaining a workable apparatus of this type in his third analyzer, the size of which was reduced to that of cigar box. The technical aspects of this intensely practical piece of apparatus were developed by an oscillograph engineer by name Prast, who is employed by the firm of Phillips, an oscillograph firm in Frankenstein, Vogtland. This is a small village located about two thirds of the way between Chemnitz and Freiberg, the map coordinates being N51/k86, GSGS 4346, Germany 1:250,000. This village is at present occupied by the Russians. All information regarding the apparatus and its whereabouts has been given to USSTAF authorities who have declared their interest in obtaining the apparatus and picking it up. Dr. Kornmueller and Mr. Prast thought that this apparatus could be used assa means of automatic signalling of "dangerous low frequencies" caused by anoxia, fatigue, or slip in pilots of air - craft or drivers of automobiles. The device is set to signal all frequencies lower than 8 per second, irrespective of exact frequencies, and the apparatus is so designed so as never to respond to frequencies above 8 per second. This is indeed an ingenious device which had wide applicability. In large bombing aircraft, for instance, a signalling device could be installed on the instrument board which would inform the pilot whether any member of his crew, who could be hooked up to a central apparatus by one lead each from their flying helmets, was falling asleep or becoming anoxic. This would allow the pilot to have complete awareness of the state of alertness of his gunners and other crew members. On the other hand, in peacetime the apparatus could be used to prevent the driver of an automobile on a long cross-country run from having a serious accident because of his falling asleep. As soon as the brainwaves slowed down at the approach of sleep, the

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apparatus could set off an alarm system which would succeed in waking him up.

4. The physiological Institute of the University of Gottingen, headed by Professor Dr. Friedrich Hermann Rein.

Dr. Rein, who has been the chairman of the Departmentor Physiology at Gottingen since 1932, was very cooperative in giving information on a variety of subjects, which included the physiology of reaction to low temperatures, the organization of medical teaching before and during the war, etc. which are embodied in separate reports (see reports on "The treatment of shock from prolonged exposure to cold, especially in water", and "The medical school curriculum in Germany"). Of neurophysiological interest is his work on pain (Rein, F.H. Zur Physiologie des Schmerzes, Schmerz, Narkose, Anasthesis 5: 129 - 139, 1939). According to Dr. Rein, pain sensation is transmitted in separate pain-conducting fibers. The adequate stimuli for the pain receptors are of a chemical nature, and these pain receptors behave in every way like chemoreceptors. Infact, they are chemoreceptors. They consist in non-myelinated fibers which enter into the tissue cells. Their adequate stimulus is any disturbance of the metabolism of that cell, and their function is merely nociceptive in the sense of Hansen. Whenever simple reflex regulation becomes inadequate in controlling metabolis disturbances, pain sets in, which is transmitted by special afferent vegetative fibers. The conformity of the physiology of pain to van't Hoff's law proves that the specific physiologic stimulus which produces pain is a chemical one. The different degrees of sensitiveness to pain exhibited by the various organ systems can be understood in the light of this fact. Muscle tissue, for instance, is not very sensitive to pain, periosteum is very sensitive. Muscle is richly vascularized, and therefore any deviation of its metabolism from the normally is quickly corrected by automatic reflex vasomotor regulation, which allows quick removal or correction of the offending metabolites. Therefore, muscle pain occurs practically only in anoxic muscle. Periosteum, on the other hand, is poorly vascularized. Interference with circulation causes pain in any organ system.

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5. The Luftfahrtmedizinisches Forschungsinstitut des Reichsluftfahrtministeriums, formerly in Berlin, now evacuated to the Physiological Institute of the University of Gottingen, directed by Professor Dr. med. et Phil. Hubertus Strughold. Oberstarzt (Colonel) der Luftwaffe, and professor of physiology with teaching appointment in aviation medicien at the University of Berlin.

Dr. Strughold was interviewed in Gottingen. He was very cooperative, and members of his staff assured me that he was very eager to cooperate to the limit with American authorities, because he felt that any assistance rendered to the United States in accelerating its victory over Japan would be in the ultimate interest of Germany. He added that his only Japanese disciple, a Dr. Miura, was probably sunk in a U-boat on his way back to Japan so impressed with the high quality of the teaching offered at his institute, that he regarded this event as a severe blow to Japanese aviation medicine. He expressed the hope that his only Chinese pupil, Dr. Ch'an Tzu Teh (a nephew of Dr. Kung) is alive and active.

Dr. Strughold then went on to explain the organization of the German aviation-medical research institutes. The Surgeon General of the Air Force (Chef des Sanitatswesens der Luftwaffe), who recently was Generaloberstabsarzt Professor Schroeder, assisted by his Chief of Staff, Oberstarzt Kanth, headed two major departments: (1) Organization and personnel, and (2) Medical procedure and research. The latter was under Dr. Becker-Freysing, who held administrative command over the seven medical research institutes of the Luftwaffe. These were: 1: Luftfahrtmedizinisches Forschungsinstitut Berlin (Dr. Strughold), with its "Aussenabteilungen", at Schloss Wolkersdorf, Berlin-Buch (brain research), Gottingen (Physiological Institute) and Brannenburg am Inn; 2: Institut fur Luftfahrtpathologie in Freiburg i.B. (Professor Buchner); 3. Institut fur Luftfahrtmedizin Munchen (Dr. Weltz) (see report on shock from exposure to cold); 4: Institut fur Luftfahrtmedizin Hamburg (Dr. Schwarz); 5: Sanitats-Versuchs- und Lehr-Gruppe Juterbog (Professor Knotte); 6: Flugphysiologische Abteilung der Erprobungsstelle

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Rechlin (Dr. Benzinger); 7: Institut fur Flugphysiologie der Deutschen Versuchsanstalt fur Luftfahrt Berlin-Allershot (Dr. Buff).

In his own institute, Dr. Strughold was assisted by 13 collaborators, who were in charge of the different special branches of aviation medicine. They were: 1. Dr. H.J. Clamann: mechanical effects of altitude, experiments on sudden increase of pressure corresponding to falls from high altitudes ("Drucksturzversuche"), low pressure chamber construction, high pressure cabin, high pressure suit; 2. Dr. U.Luft: Adaptation to high altitudes, supervision of low pressure chamber experiments, breathing devices, diet for high altitudes; 3. Dr. E. Opitz: acute anoxia adaptation to high altitudes, physiology of the coronary system; 4. Dr. F. Palme: electroencephalography, chemoreceptors; 5. Dr. O. Gauer: research on the effects of acceleration, construction of large centrifuges (one at Berlin-Tempelhof airfield, one at 35 Scharnhorststrasse, Berlin); 6. Dr. Hanson: physiology of nutrition, especially in relation to high altitudes; 7. Dr. Desaya: problems of air raid protection; 8. Dr. Schafer: chemistry; 9. Dr. Rose: spatial perception, night vision; 10. Dr. Ingeborg Schmidt: color vision; 11. Dr. Denser (zoologist): comparative physiology, micro-low-pressure chamber; 12. Dr. Autrum (zoologist): electroretinography, methodology of quantum and nuclear physics, atomic physics; 13. Dr. Suchalla: (geneticist): problems concerning experimental animals. He supervised the breeding of 250,000 white mice and of 70,000 rabbits, 2000 - 3000 of which were farmed out to every air force station (Fliegerhorst).

Dr. Strughold's own interest included selection of flying personnel especially in regard to color vision and night vision. Furthermore, he carried out various studies in the low pressure chamber, especially on the behavior of the postural and muscular reflexes, on reaction time, on the capacity to estimate time, on the problem of nutrition in relation to flying at high altitude, and on reaction time in special relationship to acceleration. Dr. Strughold is in the process of finishing a paper on the latter subject. However, he regarded as his main job during the war the dissemination of

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information on the fundamentals of aviation medicine to the medical officers of flying personnel, as well as to the manufacturers of aircraft. He wrote a series of teaching letters (Lehrbriefe). He gave one of his last copies of these teaching letters to Colonel Wright, USSTAF. In addition, in collaboration with Dr. Ruff, he published a book on aviation medicine: RUFF Siegfried, and STRUGHOLD, Hubertus: "Grundriss der Luftfahrtmedizin: 2nd edition, Leipzig, J.A. Barth, 1944. At present Dr. Strughold is preparing a report on his scientific and educational activities during the past 10 years His educational activity, or, as he put it, "the translation of the scientific results into practical useful knowledge for the use of aviation physicians", was his main preoccupation during the war. He estimated his report will be ready in 4 weeks. When asked about the problem of flying fatigue (referred to in Germany as "Abgeflogensein" which freely translated means "to be through flying", or "to be finished as a flier"), he stated that it occurred more frequently among fighter pilots than among other flying personnel. For this reason it was thought that one of the causes for this condition was to be found in the fundamental personality of the fighter pilot who was supposed to be different in personality make-up than other types of fliers. A Dr. Skawran had written a book about it entitled "The Psychology of the Fighter Pilot" ("Die Psychologie des Jagdfliegers"), which was banned and withdrawn from publication as one of the Luftwaffe's consulting physicians, Dr. Anthony, disapproved of it because of its possibly adverse psychological effect upon fliers who might read it. In Dr. Strughold's opinion "the book was not bad; it was interesting". Dr. Strughold happens to know that one existing copy is available in a monastery in Tepl, near Marienbad in Czechoslovakia. The psychological treatment of fliers with fatigue states was in the hands of the psychotherapist Professor von Hattingberg in Halle-Dolau.

Dr. Strughold then went on to generalize on certain major aspects of aviation-medical problems as he saw them developing during the war. He stated that the war could be divided into three phases. In the first phase the

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problem of the Germans was long distance flights, as against the short, rapid ascents of the British. This explains different avenues of aviation research in the two camps during that phase of the war. In the second phase of the war, the medium heavy medium-distance bomber was the problem on both sides. In the third phase of the war the Germans had to cope with the problem of rapid rise and descent during short flights incidental to the interception of bomber formations at high altitude, while the British and Americans had to solve the problem of long distance flights. In his opinion the present problem of American aviation in the Far East is that of long distance flights at great heights, which includes the recent last phase of German aviation medicine, research was focussed on the problem of nutrition in relation to physiological adaptation to rapid ascent and descent. These problems were carried out in experiments by Dr. Hansen, who is nowin Salza, Camp Dora, near Nordhausen.

Of Dr. Strughold's collaborators, Dr. Ingeborg Schmidt and Dr. Franz Palme, were interviewed. Dr. Ingeborg Schmidt devised an apparatus for the testing of color blindness. As to the problem of dark adaptation she stated that she did not think much of the "radium adaptometer" which was at one time widely used in the German Air Force. Dr. Schmidt went on to say that the principle of this adaptometer was unsatisfactory because it did not include a test of visual acuity. However, visual acuity is of special importance in form perception during dark adaptation. Furthermore, she thinks that it is impossible to devise a universal instrument which is equally good for testing the early and late phases of dark adaptation, and that the important problem is not only that of perceiving traces of light in the dark, but also that of recognizing contours, which requires visual acuity. She did feel that Comberg's Nyktometer is a good instrument for testing the first two minutes of dark adaptation.

Dr. Franz Palme, who was a scientific civilian expert employed by the Luftfahrtmedizinisches Institut, specialized in work on chemoreceptors and on electroencephalography, especially in regard to the problem of anoxia

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during rapid descent similar to descent by parachute from high altitudes. Dr. Palme feels that the critical level of oxygen pressure in the venous blood is 19.8. Adaptation to lack of oxygen is presumably possible mainly by dilatation of capillaries. He stated that he could distinguish three differen stages of deterioration of cerebral function as expressed in the electro-encephalogram. The first errors in the writing test, while the individual is subjecte to anoxia, occur when 3 per second waves in the brain make their appearance/ By these correlations he attempted to objectivise the state of deterioration of cerebral function as produced by anoxia. Palme observed tha if patients suffering from states of "abgeflogensei" (Flying fatigue states) are exposed to anoxia, slow rhythms appear earlier than in normal controls. Palme, like Kornmuller, convinced himself that in states of fatigue and related vegetative instability, 6 per second activity occurred. These findings were published by A. Benkalo and R. Gruttner. Archiv fur Psychiatrie, 111 6 1940; but Palme added that these studies concerned themselves with severe acute fatigue and not with chronic fatigue states of the "abgeflogensein" (flying fatigue) type.

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6. The Department of Serology, Experimental Therapy and Spirochaetal Research of the Deutsche Forschungsanstalt fur Psychiatrie, Kaiser Wilhelm Institut, in Munich, headed by Dr. F. Jahnel.

Dr. Jahnel is now, in addition to his other duties, director of the entire Forschungsanstalt, as Dr. Rudin fled on the arrival of the Americans. Dr. Jahnel stated that the special chemical department of which Dr. Page had been in charge until he returned to the United States, had discontinued operation after his departure and that the histological section under Professor W. Scholz is at present at Schloss Oberbrunn, Post Rittenhart, which is on the Chiem lake. He stated that Dr. Scholz had been particularly interested in anoxia, but that only very few brains had been sent to him (Jahnel thought only three altogether), because the Luftwaffe sent the vast majority of them to Dr. F. Buchner in Freiburg.

As to his routine work, Dr. Jahnel carried out serologic examinations for military and civilian hospitals including examinations of blood and spinal fluid. The annual turnover of his examinations varied somewhat but the period from 1 April 1944 to 1 April 1945 appears representative. During this period examinations of 7,750 cases were performed, of which 5,000 were members of the armed forces, 170 prisoners-of war, and the remainder civilians. In examining the blood the following serological tests were usually performed: Wassermann reaction; Meinicke-Klarungs reaction II; Kahn test; Mueller Ballungs reaction; Lentochol (Sachs-Witebsky reaction). In examining the spinal fluid the following reactions were performed: Cell Count per cu.mm.; determination of cell type; Wassermann reaction; Meinicke Klarungs reaction No. 2, Mueller Ballungs reaction; Nonne test; Pandy test; total albumin according to Kafka; Globulin/albumin ratio; sugar in mgms. percent, furthermore, the Normomastix reaction and the Goldsol reaction.

Of scientific investigations Dr. Jahnel was particularly interested in the non-specific positive syphilis reactions occurring in non syphilitic illnesses, the so-called "false positives", which occurred, for instance, after injection with horse serum, immunization for diphtheria, in and after malaria, and in other conditions (Nos.1 - 5, Appendix 9). Furthermore,

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Dr, Jahnel wrote reviews on the pathology, serology and therapy of the syphilit diseases of the nervous system (Appendix 9, Nos. 6 & 7). Apart from these published papers Dr. Jahnel reported preliminary results of confidential work which he carried out for the Wehrmacht, and which were concerned with the serological tests for malaria based on Henry's reaction with iron albuminate (unpublished paper, Appendix 9, No.8). Another confidential report concerns immunological and serological studies of relapsing fever. In these studies he transmitted seven different strains of North African relapsing fever through mice and cultures. They came from seven cases which occurred in the Africa Corps. These cases had originally been mistaken for malaria, but blood tests revealed Spirochaeta recurrens. He found that several of these strains were highly neurotropic. (Unpublished paper, Appendix 9, No.9).

In concluding the interview, certain general problems of psychiatric interest were discussed with Dr. Jahnel (who had been a general neuropsychiatrist before he specialized in serology). Regarding the handling of neurosis problems, Dr. Jahnel feels that in the first world war one had confronted this problem in a helpless manner. He feels this problem has now been solved by means of suggestive treatment with the aid of painful electric currents, as well as by the policy of not letting the patients attain the goals which the illness served. In the last war, the patients definitely felt that they could attain things by their illness, while in this war they could not.

7. <u>The Genealogic Section of the Deutsche Forschungsanstalt fur Psychiatrie, Kaiser Wilhelm Institut, in Munich, formerly headed by Dr. E. Rudin</u>.

On visiting Dr. Rudin's department I found that he had fled, presumably because of the part that he had played in the program of killing the insane. He felt that some of the relatives of the killed patients might exact retribution from him because in the course of this program not only were incurable defectives killed

but also patients suffering from remedial illnesses, such as depressions or

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or brain tumors. Spot-checking of Dr. Rudin's files failed to produce any of the material on the organization of the killing centers. I was told that he had destroyed all damaging evidence. However, among the files dealing with international meetings, interesting material was found in three of them. One was a file containing all reports, including confidential ones, concerning the International Neurological Congress and the International Congress for Psychotherapy held in Copenhagen in 1939. This included two confidential reports, one by Professor Kretschmer, the other by Professor Mauz containing the status and personnel of German psychotherapy with those of other countries, which will be discussed in another report, to be prepared by me, on German military neuropsychiatry and neurosurgery. Other files, such as those concerning the European Congress on Mental Hygiene held in Prague in August 1938, and the meeting of the International Union for the Scientific Investigation of Population Problems held in Paris in August 1937, contain material which is of interest for a third report in preparation, namely: "Measures concerning public mental health, including sterilization and execution of the insane, in Germany". The report on the Congress in Paris also contained a confidential mimeographed manuscript, entitled "Kongresswesen und Hohe Politik".(International meetings and foreign politics), which contains an interesting set of rules and methods by which participants in International Congresses were supposed to serve the interests of Nazi Germany. This leaflet and associated material from the reports will be made the subject of a special small report entitled: "Methods for Influencing International Scientific Meetings, as laid down by German Scientific Organizations."

8. Conclusions;

The work of a number of scientific organizations in the field of neuropathology and neurophysiology, with special regard to electroencephalography, was reviewed. Among those who worked up the vast material of gunshot wounds of the brain and of other open injuries inflicted by missiles, preoccupation with the problem of infection is striking. This is probably due to the

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fact that penicillin was unknown or not available in Germany during the war.

In the field of neurophysiology, the electroencephalographic correlates of anoxia and severe acute fatigue states approaching sleep, were thoroughly studied by Kornmueller and his staff. However, the correlation of the findings obtained in severe acute fatigue states with the far less striking and sporadic findings found in the chronic fatigue states of military personnel, especially of aviators (flying fatigue - "abgeflogensein") which was postulated by Kornmueller and others, is not to be considered as proven yet; nor is it a convincing hypothesis that these findings in chronic fatigue states represent an actual structural and irremediable organic change of the brain. Halme's related finding that under conditions of experimental anoxia, slow rhythms can be elicited earlier in patients suffering from flying fatigue than in normal persons, are far more convincing in that they allow an interpretation of the picture in terms of functional deviation rather than of static alteration.

The survey reported in this paper unearthed one new invention of great practical interest: namely a signalling apparatus for dangerous slowing of the cerebral electro-activity, such as brought about by anoxia or by intense fatigue approaching sleep. This apparatus is of small convenient size. It was developed by Dr. Kornmueller and Mr. Prast, the latter an oscillograph engineer employed by the Phillips Oscillograph Company, at present in Frankenstein-Vogtland, N51 K86, GSGS 4346, Germany 1: 250,000. The apparatus is at present in the hands of Mr. Prast, and should be obtained from him. The promising potentialities of great practical usefulness of this apparatus are discussed in the body of this report on pages 35 and 36.

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/s/ Leo ALEXANDER

/t/ LEO ALEXANDER
Major, M.C.

APPENDIX 1.

I. L u f t w a f f e (Air Force)

(Aussenstelle fuer Gehirnforschung des Luftfahrtmedizinisches Forschungsinstitutes)

1. Oberfeldarzt Prof. Spatz
2. Stabsarzt Dr. Lindenberg
3. Stabsarzt Doz. Dr. Peters
4. Stabsarzt Dr.med.habil.Noetzel
5. Stabsarzt Dr.med.habil,Kruecke
6. Oberarzt Dr.med.habil.Welte
7. Oberarzt Dr. Seele
8. Stabsarzt Dr. Dinkelmeyer
9. Sonderfuehrer Dr.phil.Gruettner
10. Oberarzt Dr. Gremmler
11. Stabsarzt Dr.med.habil.Link
12. Oberarzt Doz.Dr.Noell
13. Stabsarzt Dr.Klaue
14. Stabsarzt Dr. Lepp
15. Stabsarzt Dr. Knoell
16. Oberstabsarzt Dr.Rotter
17. Stabsarzt Dr. Orthner

II. H e e r (Army)

(Aussenstelle der Militaerarztlichen Akademie zur Erforschung der Kriegsschaeden des Zentralnervensystems.)

18. Oberfeldarzt Dr. Patzig
19. Prof. Hallervorden
20. Stabsarzt Dr. Kornmueller
21. Oberarzt Dr. med. habil.Eicke
22. Stabsarzt Dr. Friedrich
23. Oberarzt Dr. Janzen
24. Stabsarzt Doz. Dr. Volland
25. Stabsarzt Dr. Will
26. Stabsarzt Dr. Graber

III. C i v i l i a n S e c t o r

27. Dr. Koepf
28. Dr. Charlotte Kruecke
29. Doz. Dr. Zuelch
30. Doz. Dr. Selbach **
31. Dr. Bustamante (Madrid) *
32. Dr. v. Bagh (Finland) *
33. Dr. Weisschedel **
34. Dr. Thea Lueers
35. Dr. Herta Lange-Cosack
36. Dr. Vera Gaupp
37. Doz. Dr. Irsigler
38. Dr. Gerlach
39. Dr. Germain Voldet (Genf) *
40. Dr. Gruner

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41. Dr. Diepen (Amsterdam)

42. Prof. Toennis

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* = Stipendiaten der Alexander v. Humboldt-Stiftung

** = Stipendiaten der Deutschen Forschungsgemeinschaft.

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Appendix 2.

Pathological-anatomical papers on closed and open Injuries of the Central Nervous System from the Aussenabteilung fuer Gehirnforschung des Luftfahrtmedizinischen Forschungsinstitutes (formerly Gehirnforschungsstelle der Luftwaffe.) Leiter : Oberfeldarzt Prof. S p a t z) and from the Kaiser-Wilhelm Institut fuer Hirnforschung.

- from -

1940 to 1945.

I. Published papers :

1) H. S p a t z : Gehirnpathologie im Kriege. Von den Gehirnwunden, Zentralbl. Neurochirurg. 6: 162-212 (1941)

2) H.H. D i n k e l a e y e r : Der innere Prellschuss des Gehirnschaedels, Nervenarzt 16 : 110 - 120 (1943)

3) F.J. I r s i g l e r : Ueber den Heilverlauf experimenteller Hirnwunden bei offener und verlegter Knochenluecke, Zbl. Neurochirurgie 7 : 1 - 43 (1943)

4) I r s i g l e r und S u e d h o f : Experimentelle Untersuchungen ueber die Infektion von Hirnwunden, Zbl. Neurochirurgie 8 : 32 - 106 (1943).

5) G. P e t e r s : Die Gehirnveraenderungen bei stumpfer Gewalteinwirkung von vorn (auf die Stirn), Luftfahrtmed. 7 : 344 - 379 (1942)

6) G. P e t e r s : Ueber gedeckte Gehirnverletzungen (Rindenkontusion) im Tierversuch, Zbl. Neurochirugie 8 : 172 - 207 (1943).

7) G. P e t e r s und H. S e l b a c h : Ueber die Neutralisationsfaehigkeit des Hirngewebes und ihre Beziehung zu den histopathologischen Veraenderungen nach experimentellen Hirnkontusionen, Arch.Psychatr. 116 : 531 - 552 (1943).

8) H. N o e t z e l : Ueber die pathologische Anatomie der traumatischen Meningitis bei Hirnschussverletzung, Arch. Psychiatr. 115 : 392 - 418 (1943).

9) H. N o e t z e l : Zur Kenntnis und Abgrenzung des subduralen Empyems, Zbl. Allg. Path.u.Path.Anat.81 : 3 - 10 (1943).

10) H. N o e t z e l : Die Mitbeteiligung des Gehirns bei der traumatischen Leptomeningitis, Arch.Psychiatr. 117 : 275 - 308 (1944.)

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11.) W e l t e E : Zur formalen Genese der traumatischen Mydriasis. Oculomotoriuswurzelschaedigung durch einseitiges Vorquellen des Uncus hippocampi, Zbl. Neurochirurgie 8: 217 - 234 (1943)

12). H. L e p p : Ueber odontogene Meningo-Encephalitis mit subduralem Empyem, Dtsch.Zahn-, Mund- u. Kieferheilkunde 1o: 379 - 400 (1943)

13). K.H. L i n k : Traumatische subdurale Blutung - Pachymeningitis haemorrhagica, Monographien a.d. Gesamtgebiet d.Konstitutions-u.Wehrpathologie 55 : 1 - 220 (1945)

14). K.J. Z u e l c h : Die Entstehung des Hirndrucks, insbesondere des Prolapses bei der Hirnwunde und ihren Folgezustaenden. Zbl.Neurochirurgie 6 : 212 - 232 (1941) x

II. Papers in Press :

15). R. K l a u e : Ueber die indirekten Brueche der vorderen Schaedelgrube beim Schaedelschluss, Zbl. Neurochirurgie.

16). R. K l a u e : Beitrag zur pathologischen Anatomie der Kriegsverletzungen des Rueckenmarkes mit besonderer Beruecksichtigung der Rueckenmarkskontusion. Ein Vergleich zwischen Rueckenmarks- und Gehirnverletzung, Arch. Psychiatrie.

17). E. W e l t e : Zusammenhaenge zwischen anatomischem Befund und klinischem Bild bei den Rindenprellungsherden nach stumpfen Schaedeltrauma, Arch.Psychiatr. 118 : 200 - 267 (1945). (Der bereits fertige Drucksatz wurde bei dem Luftangriff auf Wuerzburg vernichtet.

18). H. S p a t z : Aus dem Gebiete der Gehirnpathologie mit besonderer Beruecksichtigung der Luftfahrtmedizinischen Belange. Festschrift fuer den Chef des Wehrmacht-Sanitaetswesens.

19.) H. S p a t z : Kopfverletzungen, Handwoerterbuch der Luftfahrt - Medizin.

2o.). K.H. L i n k : Zur Unfallbegutachtung der subduralen Blutung und der Pachymeningitis haemorrhagica.Zbl. Neurochirurgie.

21). A. K r u e c k e : Die Fettembolie des Gehirns, besonders nach Flugzeugunfaellen. Luftfahrtmedizin.

x : Aus der Abteilung fuer experimentelle Pathologie (Prof. Toennis) des Kaiser-Wilhelm-Institutes fuer Hirnforschung.

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22). R. L i n d e n b e r g : Ueber indirekte Erweichungen bei offenen Verletzungen des Grosshirns und ihre Bedeutung fuer das klinische Bild. Arch.Psychiatrie 118.

23). K.J. Z u e l c h : Die Konturschuesse des Schaedels. Militaerarzt.

III. Papers nearly completed.

24). G. P e t e r s und H. S p a t z : Die Rindenprellungsherde bei stumpfer Schaedelverletzung. Ihre Entwicklung und ihre differentialdiagnostische Bedeutung. Vorgesehen fuer Ziegler's Beitraege zur anatomischen Pathologie.

25). H. N o e t z e l : Ueber den aeusseren Prellschuss des Hirnschaedels (Impressionsschuss ohne Duraverletzung mit Hirnverletzung). Vorgesehen fuer Zbl. Neurochirurgie.

26). K.H. L i n k : Die Infektion der inneren Liquorraeume bei 200 Faellen von Schussverletzungen des Zentralnervensystems.

27). R. L i n d e n b e r g und W. N o e l l : Veraenderungen des Gehirns nach Strangulation beim Flugzeugueberschlag und das Problem der Ueberlebenszeit. Ueber die Bedeutung der Klasmatodendrose der Neuroglia.

IV. Investigations in progress

28). E. W e l t e und K. K l o o s : Zum Problem der toedlichen Commotio cerebri.

29). E. W e l t e : Die Hirnstammblutung bei stumpfer Gewalteinwirkung auf dem Schaedel.

3o). E. W e l t e : Anatomisch nachgewiesene Hirnkontusion als Nebenbefund.

31). H. S p a t z : Commotio cerebri und Contusio cerebri auf Grund anatomischer Befunde.

32). H. S p a t z : Die pathologische Anatomie der gedeckten und offenen Verletzungen des Zentralnervensystems.

33). H. N o e t z e l : und H. S p a t z : Das Schicksal der Nekrosen bei der Hirnschussverletzung.

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34). W. R o t t e r : Encephalitis traumatica.

V. Investigations planned :

35). Die Markblutungen bei stumpfer Gewalteinwirkung auf den Schaedel.
(P e t e r s und W e l t e).

36). Die offenen Verletzungen des Rueckenmarks. (K l a u e und S p a t z).

37). Der traumatische Hirnabscess (L i n k)

38). Die Entstehung der traumatischen Hirncysten (L i n k)

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APPENDIX 3

PUBLICATIONS FROM THE ANATOMISCHE ABTEILUNG DES KAISER-WILHELM-INSTITUTES fuer HIRNFORSCHUNG (PROF. SPATZ)

- From -

1939 to 1945

1. Published papers

1939

1. SPATZ H. : Pathologische Anatomie der Kreislaufstoerungen des Gehirns, Z. Neur. 167, 115 - 171, 1939

2. LINDENBERG R: und SPATZ. H.: Ueber die Thromboendarteritis obliterans der Hirngefaesse (Cerebrale Form der v. Winiwarter-Buerger'sch Krankheit), Virchows Arch. 305, 531 - 557, 1939.

2. DRIGGS.H. und SPATZ H. : Pubertas praecox bei einer hyperplastischen Missbildung des Tuber cinereum, Virchows Arch. 305, 567,1939

3. WELTE E. : Die Atrophie des Systems des Bruckenfuesse[illegible] und der unteren Oliven, Arch. Psychistr. 109, 650-698, 1939

4. WELTE E. : Methode der Hirnsektion und makroskopische Diagnostik, Zbl. Allg.Path. u.Path. Anst. 67, 390-400, 1939

5. BEXKER H. : Experimentelle Verschluesse von Arterien und Venen des Gehirns und ihre Einwirkung auf das Gewebe, Z.Neur. 167, 546-553, 1939

6. HASENJAEGER TH: Ueber seitenventrikelnahe Gliome als eine besondere Gruppe unter den Grosshirngeschwulsten, Arch.Psychistr. 110, 570-604 1939.

7. HASENJAEGER TH: Ueber die Ependymitis blastomatosa bei ventrikelnahen Gliomen, Arch.Psychiatr. 110, 605-632, 1939

8. SCHOEPE M.: Zur Frage " Blastom -Encephalitis ", Arch.Psychiatr. 109, 755-784, 1939

1940.

9. SPATZ H.: Oskar Vogt zum 70. Geburtstag, Der Nervenarzt 13, 145-154, 1940

10. Dei FOLL. . und ZUCHA. J. : Beitraege zur Kenntnis der Anomalien und der Erkrankungen der Arteria carotis interna, Zbl. Neurochirurg. 5/6, 209-238, 1940

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11.) KRUECKE CH.: Ueber das Vorkommen von Knochengewebe in Gehirnarterien, Arch. Psychiatr. 111, 233-250, 1940.

12. KLAUE R. : Parkinson'sche Krankheit (Paralysis agitans) und postencephalitischer Parkinsonismus. Versuch einer klinisch-anatomischen Differentialdiagnose, Arch.Psych. 111, 251-321, 1940.

1941

13. Bagh.K. v.: Ueber anatomische Befunde bei 3o Faellen von systematischer Atrophie der Grosshirnrinde (Pickscher Krankheit). Eine vorlaeufige Mitteilung, Arch.Psychiatr.114, 68-70 1941.

1942

14. SPATZ H. : Grundriss der pathologischen Anatomie der Geisteskrankheiten. Lehrbuch d. Geisteskrankheiten von O.Bumke, 5.Aufl. 1942

15. BUSTAMANTE M., SPATZ. H. und WEISSCHEDEL, E.: Die Bedeutung des Tuber cinereum des Zwischenhirns fuer das Zustandekommen der Geschlechtsreife, Dtsch.Med.Wschr. 1, 289, 1942.

16. WEISSCHEDEL E. und SPATZ H.: Ueber die gonadotrope Wirksamkeit des Tuber cinereum bei Ratten, Dtsch.Med.Wschr.1121. 1942.

1943

17. BUSTAMANTE. M. : Experimentelle Untersuchungen ueber die Leistungen des Hypothalamus besonders bezueglich der Geschlechtsreifung, Arch.Psychiatr. 115, 419-468, 1943.

18. LUEPS TH.: Weitere Mitteilungen zur Klinik und Antomie der cerebralen Form der Thromboendangiitis obliterans. (v. Winniwarter - Buerger'sche Krankheit), Arch.Psychiatr. 115, 2. H., 319-348 1943.

1944

19. LANGE-COSACK H.: Die Hydranencephalie (Blasenhirn) als Sonderform der Grosshirnlosigkeit, Arch.Psychiatr. 117, 1-51 und 595-640 1944.

1. Papers in press :

2o. BAGH K. v.: Klinische und anatomische Studien an 3o Faellen von Umschriebener Atrophie der Grosshirnrinde (Pick'scher Krankheit), Monographien a.d.Gesamtgebiet f.Psychiatr.u.Neurologie.(Beim Luftangriff auf Leipzig zerstoert)

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21. SPATZ H. : Ueber den Entzuendungsbegriff in der Neurologie. Aussprache zum Ref. R o e s s l e r s, Verhandlung d. Deutschen Pathologischen Gesellschaft in Breslau 1944.

22. GERLACH J.: Ueber die Gehirnentwicklung bei den Selachiern.

23. SPATZ H., GAUPP V. und WEISSCHEDEL E :Zwischenhirn und Sexualfunktionen, Arch. Psychiatr.

24. SPATZ H., DIEPEN RL und GAUPP. V.: Beitrag zur normalen Anatomie des Tuber cinereum und des Infundibulum beim Kaninchen. Zur Frage der Verbindung zwischen hypothalamischem Sexualzentrum und Hypophyse, Arch. Psychiatr.

III. Papers in progress ;

25. SPATZ H.: Beobachtung ueber Folgezustaende nach intrauteriner Kohlenoxydvergiftung (Fall Scheumert)
(Zusammen mit Prof. O. V o g t).

26. GAUPP.V., und GRUNER J.: Ueber den Sitz des Sexualzentrums im Tuber cinereum des Kaninchens.

27. DIEPEN. R Vergleichend anatomische Untersuchungen ueber das Tuber cinereum

28. LANGE-COSACK H.: Weitere Beitraege zur pathologischen Anatomie der Pubertas praecox.

29. SPATZ H. : Wege und Ziele der Hirnforschung.

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APPENDIX 4

MISCELLANEOUS RELATED PUBLICATIONS FROM OTHER DEPARTMENTS OF THE KAISER WILHELM INSTITUT FUER HIRNFORSCHUNG

- From -

1939 to 1945

Published papers: 1939

1. TOENNIS. W. und GRIPONISSIOTIS. B. : Zur operativen Behandlung der posttraumatischen Spaetepilepsie.
Arch. f.Klin.Chirurgie 196, 515-533, 1939

2. TOENNIS.W. UND ZUELCH. K.J. : Intakranielle Ganglienzellgeschuelste (mit ausfuehrlicher Beschreibung einer einheitlichen Gruppe im Grosshirn), Zentralbl. Neurochirurgie 4, 273-307, 1939

3. WEBER.E.: Die Teratome und Teratoide des Zentralnervensystems, Zentralbl. f. Neurochierurgie 1, 47-57, 1939

4. RIESSNER, R. und ZUELCH K.J.: Ueber die Formveraenderungen des Hirns (Massenverschiebungen, Zisternenverquellungen) bei raumbeengenden Prozessen, Dtsch.Zeitschr.f.Chirurgie 253, 1-61,1939

5. ZUELCH. K.J.: Die Gefaessversorgung der Gliome,Zeitschr.f.d.ges.Neurolgie u.Psychiatr. 167, 585-592, 1939.

6. ZUELCH. K.J.: Zur Klassifikation der Hirntumoren, Psychiatr.-neurolog. Wochenschr.41. Jahrgang, 3, 1-5, 1939. Festausgabe aus Anlass des Eintritts dieser Fach-Wochenschrift in ihr 5. Lebensjahrzehnt.

7. ZUELCH.K.J.: Ueber die Pathologie der Gliome, Fortschritt [illegible] Neurologie Psychiatr.zl. Jahrgang, H. 3, 121-137, 1939

8. ZUELCH. K.J.: Ueber die geschichtliche Entwicklung und den heutigen Stand der Klassifikation der Hirngeschwuelste (unter besonderer Beruecksichtigung der Gliome).
Zentralbl.f.Neurochirurgie 4/5,251-335 1939

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1940

9. ANDERS. H.E.und EICKE. W.J.: Die Hirngefaesse beim Hochdruck, Arch. Psychiatr. 112, 1-4, 1940

10. FERRET G.: Experimentelle Untersuchungen ueber Massenverschiebungen und Formveraenderungen des Gehirns bei Volumenzunahme durch Oedem oder Schwellung. Arch.Psychiatr. 112, 385-408, 1940

11. FERRET.G. und SELBACH H.: Chemische Untersuchungen bei experimentellen Massenverschiebungen und Formveraenderungen des Gehirns, Arch.Psychiatr. 112, 441-468, 1940

12. SELBACH. H. : Physikalisch-chemische Untersuchungen zur Frage der Hirnvolumenvermehrung (Hirnschwellung und Hirnoedem). ARCH.Psychiatr. 112,409-440, 1940.

13. ZUELCH. K.J. : Das Medulloblastom vom pathologisch-anatomischen Standpunkt aus, Arch. f. Psychiatr. 112, 343-367, 1940.

14. ZUELCH K.J. : Die Pathologie der Hirngeschwuelste (insbesonders der Gliome) und ihre Bedeutung fuer die Klinik. Wiener Klin.Wchschr.Jahrg.53, 25, S. 498, 1940

15. ZUELCH. K.J. : Hirngeschwuelste im Jugendalter. Zentralbl.f. Neurochirurgie, 5. Jahrgang 5/6, 238-274 1940.

1942

1. TUENNIS. W.: Richtlinien fuer die Behandlung der Schussverletzungen des Gehirns und die Beurteilung ihrer Folgezustaende. 1-73, J.F.Lehmann Muenchen 1942

1943

1. STENDER A. und ZUELCH. K.J.: Ueber die Ventrikeltumoren bei tuberoser Sklerose Zeitschr. f.d.Ges.Neurol.u.Psychiatr. 176,556-578

2. ZUELCH K.J. : Hirnoeden und Hirnschwellung, Virchows Arch. 310, S.1-56 1943.

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APPENDIX 5

INDEX OF PUBLICATIONS FROM DR. HALLERVORDEN'S SPECIAL PATHOLOGIE SECTION OF THE KAISER WILHELM INSTITUT FUER HIRNFORSCHUNG *

- From -

1939 to 1945

1939

1. Ueber Spaetfolgen von Hirnschwellung und Hirnoedem, namentlich bei Schwachsinnigen und Idioten. Vorlaeufige Mitteilung, Psychiatr. - neurol. Wschr. 2, 1939.

(Kreislaufstoerungen in der Aetiologie des angeborenen Schwachsinns. Vortrag in der Berliner Path.Ges. 12.1.1939.)

(Hydrocephalus infolge von atrophischen Degenerationsprozessen. Vortrag in der Berliner Gesellschaft fuer Kinderheilkunde. 17.2.39)

2. Kreislaufstoerungen in der Aetiologie des angeborenen Schwachsinns, Z. Neur. 167, 527.

3. Ueber die Einrichtung von Prosekturen in Heil- und Pflegeanstalten. Referat fuer den Ausschuss fuer prakt.Psychiatrie in der Gesellschaft der Neurologen und Psychiater. Wiesbaden 1939, Z.Psych.Hyg. 12, 121.

4. Ueber zentrale Entmarkungskrankheiten. Ref. auf der 64. Wanderversammlung der suedwestdeutschen Neurologen- und Psychiater in Baden-Baden. 3.6.39., Dtsch.Z.f.Nervenheilk. 150, 201, 1940.

Balthassar, Ueber die Beteiligung des Globus pallidus bei Athetose und Paraballismus, Dtsch.Z.Nervenheilk. 148, 243.

Kruecke. W. Die mukoide Degeneration der peripheren Nerven, Virchow's Archiv, 304, 442.

1940

Volland. W. Ueber intracerebrale Gefaessverkalkungen : die idiopathische Form mit vorwiegend extrapyramidalem Krankheitsbild nebst Bemerkungen zur Sturge-Weberschen Krankheit, Arch.Psychiatr. 111, 5

* All numbered publications are available in microfilm through CIOS Secretariat

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8. Noetzel.H. Diffusion von Blutfarbstoff in der inneren Randzone und aeusseren Oberflaeche des Zentralnervensystems bei subarachnoidaler Blutung, Arch. fuer Psychiatr. 111, 129

9. Laubenthal. F. und Hallervorden. J. Ueber ein Geschwisterpaar mit einer eigenartigen fruehkindlichen Hirnerkrankung und seiner Sippe, Arch. fuer Psychiatr. 111, 712

1o. Eicke.W.J. Neue Beobachtung ueber die Hallevorden-Spatzsche Krankheit Arch.Psychiatr. 111, 514

11. Ammermann, Isolierte Schaedigung der unteren Olive bei Myoklonusepilepsie Arch. Psychiatr. 111, 215

12. Jenz, Hirnveraenderungen nach einem 1o Monate vor dem Tode vorgenommenen Erhaengungsversuch. D.I. Berlin 1940

Nekrolog Oskar Rein, Psychiatr, Neurol.Wschr. 33, 1940 (not available)

1941

13. Hirnerschuetterung und Thixotropie. Zbl. Neurochr.37, 1941.

14. Birnbaum, Chronisch progressive Chorea mit Kleinhirnatrophie, Arch. Psychiatr. 114, 160

15. Eicke, W.J. Wilson-Pseudosklerose ohne Lebercirrhose, Arch.Psychiatr. 114, 214

16. Goetze. W. und Kruecke W. Ueber Paramyloidose mit besonderer Beteiligung der peripheren Nerven und granulaerer Atrophie des Gehirns, Archiv. fuer Psychiatr. 114, 183

17. Kruecke.W. Odem und seroese Entzuendung im peripheren Nerven, Virchows Archiv 1, 308

1942

18. Kruecke.W. Zur Hispopathologie der neuralen Muskelatrophie, der hypertrophischen Neuritis und der Neurofibromatose, Arch.Psychiatr. 115, 180

19. Volland. W. Beitrag zur Kenntnis der Gehirnschaeden bei Trichinose, Arch.Psychiatr. 115, 349

2o. Die pathologisch anatomischen Veraenderungen im Zentralnervensystem beim Fleckfieber, Militaerarzt 8, 26

(Hirnschaedigung nach Kohlenoxydvergiftung im Mutterleib. Vortrag in der Neurologisch-Psychiatrischen Gesellschaft in Berlin. 14.12.42). not available.

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21. Eicke. W.J. Beitrag zur Pathologie der Substantia nigra, Archiv Psychiatr. 115, 549

22. Nekrolog Franz Schob, Arch.Psychiatr. 116, 347

23. Encephalitis und Polyneuritis, Nervenarzt 16, 417

24. Eicke, W.J. zur Frage der fetalen Encephalitis, Meningitis und ihrer Folgeerscheinungen, Arch. Psychiatr. 116, 568

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25. Oligodendrogliom nach Hirntrauma, Arch. f. Psychiatr. ?

26. Seltenere Formen encephalitischer Erkrankungen: Infedtioese Granulome und blastomenoephalitis. Beitrag zur Festschrift fuer Von Loser (nicht gedruckt)

27. Ueber miltiple und konzentrische Sklerose. Vortrag in der med.naturwissenschaftl.Ges. in Jena 16.11.44 (wird spaeter in den Schriften der Gesellschaft erscheinen).

28. Vom Bau und Leben des Gehirns. Oeffentlicher Vortrag Dillenburg. 3.2.45 not available.

Wilke, Ueber eigenartige entzuendliche Erkrankungen des Zentral - nervensystems: Infektioese Granulome des Gehirns. Zugleich ein Beitrag zur Frage : Blastom-Encephalitis. (Vortrag 2o.3.44 in der Psychiatr. Ges. in Berlin) Soll in Virchows Archiv erscheinen. not available.

28. Volland. W. Zur Frage der parainfektioesen (perivenoesen) Encephalitis (Impf- und Masernencephalitis). Virusinfektion der allergische Krankheit ? Druckgenehmigung versagt. Ein Vortrag gleichen Inhaltes auf der Pathologischen Gesellschaft in Breslau, Juni 1944.

29. Eicke.W.J. Gefaessveraenderungen bei Meningitis und ihre Bedeutung fuer die Pathogensse fruehkindlicher Hirnschaeden. Habilitationsschrift soll in Virchows Arch. erscheinen.

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PUBLICATIONS BY DR. A.E. KORNMULLER AND HIS SOLLABORATORS, 1939-1944 *

1. R. JANZEN und A.E. KORNMULLER. Oertliche Unterschiede hirnbioelektrischer Erscheinungen von kranken Menschen bei Ableitung durch die Kopfschwarte, Arch.f. Psychiatr. 109, 247 1939

2. R. JANZEN und A.E. KORNMULLER. Einige Erforschungen ueber die Anwendung der hirnbioelektrischen Lokaldiagnose krotikaler Prozesse bei Ableitung durch die Kopfschwarte des Menschen, Psychiatr. neur.Wschr. 41, 5, 1939

3. A.E. KORNMUELLER und R. JANZEN . Die Methodik der lokalisierten Ableitungen hirnbioelektrischer Erscheinungen von der Kopfschwarte des Menschen, ihre Begruendung und Begrenzung, Z. Neur. 166, 287, 1939

4. R.JANZEN und A.E. KORNMUELLER. Hirnbioelektrische Erscheinungen bei Aenderungen der Beweisstseinslage, Dtsch.Z.Nervenheilk. 149, 74, 1939.

5. A.E. KORNMUELLER und R.JANZEN. Ueber die normalen bioelektrischen Erscheinungen des menschlichen Gehirns. (Gleichzeitig eine kritische Stellungnahme zu den bisherigen Anschauungen auf Grund neuer Befunde an Gesunden und Kranken) , Arch.f.Psychiatr. 110, 224, 1939

6. A.E. KORNMUELLER. Neuere Ergebnisse der hirnbioelektrischen Untersuchungen an gesunden Menschen.
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7. A.E. KORNMUELLER. Einige Voraussetzungen der hirnbioelektrischen Untersuchung des Menschen, Dtsch.med.Wschr. 43, 1601, 1939

8. A.E. KORNMUELLER. Weitere Ergebnisse ueber die normalen hirnbioelektrischen Erscheinungen des Menschen bei Ableitung durch die Kopfschwarte. Einblicke in den Mechanismus der corticalen Erregungsablaeufe und in die regionale Gliederung der Hirnrinde, Z.Neur. 168, 248, 1940

9. A.E.KORNMUELLER. Ueber einige bei Willkuerbewegungen und auf Sinnesreize auftretende bioelektrische Erscheinungen der Hirnrinde des Menschen, Z.Sinnesphysiol. 68, 119, 1940.

* The publications marked by asterisks are available in microfilm from through the CIOS Secretariat.

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A.E. KORNMUELLER. Einige weitere Erfahrungen ueber die Lokalisation von Tumoren und anderen herdfoermigen Erkrankungen des Gehirns mittels der hirnbioelektrischen Lokalisationsmethodik, Zbl. Neurochir. 5, Jg.Nr. 2, 75, 1940

R.JANZEN und A.E.KORNMUELLER. Hirnbioelektrische Untersuchungen an Kranken mit symptomatischer Epilepsie, Dtsch.Z.Nervenheilk. 150, 283 1940

A.E.KORNMUELLER. Die hirnbioelektrische Untersuchung des Menschen. I. Die Grundlage der Methodik und das Verhalten des Gesunden, Fortschr. Neur. etc. XII, 193 1940

A.E. KORNMUELLER und R. JANZEN. Hirnbioelektrische Untersuchungen bei genuiner Epilepsie, Dtsch.Z.Nervenheilk. 152, 78, 1941

A.E.KORNMUELLER, F.Palme und H. Strughold. Ueber Veraenderung der Gehirnaktionsstroeme in akutem Sauerstoffmangel, Luft.Med. 5, 161, 1941

A.E.KORNMUELLER. Hans Berger, Muench. Med.Wschr. 32, S.889, 1941

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A.E.KORNMUELLER,F. PALME und H. STRUGHOLD. Die Ableitung der Gehirnaktionsstroeme, Eine Methode zur Untersuchung der Hoehenkrankheit, Kli.Wo. 21,5-8. 1942 Jb.Luft.Med.

A.E.KORNMUELLER. Die Wirkung der Kohlensaeure bei Epilepsie und Schizophrenie auf Grund hirnelektrischer Befunde, Muench. Med. Wschr., No. 2, 30, 1942

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20. NOELL, KORNMUELLER und Gremmler : Ueber den Paradoxeffekt der Sauerstoffgabe, Arch.f.Psych. 116, 3, Heft, S. 394-416, 1943

21. A.E. KORNMUELLER. Die klinische Bewertung derElektrenkephalogramme, Arch. f.Psych. 116, 4, Heft, S. 608-647, 1943

22. A.E.KORNMUELLER, Gremmler ; Praepileptische Zeichen in Elektrenkephalogrammen von Kopfverletzten, Kli. Wo. 153, 22-23, 1944

23. A.E.KORNMUELLER, u. W. NOELL: Ueber den Einfluss der Kohlensaeurespannung auf bioelektrische Hirnrindenphaenomene, Pflugers Arch. 247, Band, 6. Heft, S. 660-684 1944

W.NOELL u. A.E.KORNMUELLER. Zur Sauerstoffmangelwirkung auf die Hirnrinde, Pfluegers Arch. 247, Band, 6. Heft, S. 685-712, 1944

25. A.E.KORNMUELLER u. W. NOELL . Zur Frage der Beeinflussung der Sauerstoffmangelwirkung durch Kohlensaeure, Pfluegers Arch. 247. Band, 6. Heft. S.

26. A.E.KORNMUELLER, Klinische Elektrenkephalographie, J.F. Lehmanns Verlag 1944, Monographie, 1-147

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APPENDIX 7

Additional physiological papers from the Aussenabteilung fuer Gehirnforschung des Luftfahrtmedizinischen Forschungsinstitutes

- From -

1941 to 1945

Published papers

1941

1. NOELL. W. ,& SCHNEIDER.M.: Die Gehirndurchblutung bei Sauerstoffmangel und bei Uebergang von Sauerstoffmangel auf reinen O2 und auf O2/CO2.-genische, Luftfahrtmedizin 5, 234-25o, 1941.

2. NOELL W. & SCHNEIDER M.: Ueber die Wirkung der Kohlensaeure auf Blutdruck und Gehirndurchblutung im Sauerstoffmangel, Luftfahrtmedizin, 5, 251-262 1941

1942

3. NOELL W.: Ueber die Wirkung des Theophyllins und der verschiedenen Loesungsvermittler auf die Gehirndurchblutung, Zeitschrift fuer die gesamte experimentelle Medizin. 110, 589-600, 1942

4. NOELL. W. & SCHNEIDER.M.: Ueber die Durchblutung und die Sauerstoffversorgung des Gehirns im akuten Sauerstoffmangel, 1.Mitteilung : Pfluegers Archiv 246: 181-200, 1942

5. NOELL.W. & SCHNEIDER M.: Ueber die Durchblutung und die Sauerstoffversorgung des Gehirns im akuten Sauerstoffmangel, 11.Mitteilung : Der Liquordruck, Pfluegers Archiv. 246: 201-206, 1942

6. NOELL.W. & SCHNEIDER M.: Ueber die Durchblutung und die Sauerstoffversorgung des Gehirns im akuten Sauerstoffmangel, 111. Mitteilung : Die arterio-venoese Sauerstoffmangel und Kohlensaeuiedifferenz. Pfluegers Archiv, 246, 207-249, 1942

7. GREMMLER. J.: Die Beziehungen der Hypoxaemie zum epileptischen Anfall und zu den Hochenkraempfen. Der Nervenarzt 15, 467-476, 1942

1943

8. NOELL,W. und ROEDER W.: Zur Erholung aus Sauerstoffmangel insbesondere ueber den Paradoxeffect der Sauerstoffgabe. Luftfahrtmedizin.8, 339-356 1943.

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9. NOELL, W. & SCHNEIDER M.: Ueber die Flimmerbereitschaft des Herzens in der Erholung nach schwerstem Sauerstoffmangel, Zeitschrift fuer die gesamte experimentelle Medizin. 113. 270-281, 1943.

10. NOELL W. & SCHNEIDER M.: Ueber die Durchblutung und die Sauerstoffversorgung des Gehirns, IV. Mitteilung : Die Rolle der Kohlensaeure, Pfuegers Archiv 247: 514-527, 1943

11. NOELL W. Ueber die Durchblutung und die Sauerstoffversorgung des Gehirns V. Mitteilung : Einfluss der Blutdrucksenkung. Pfluegers Archiv. 247, 528-552, 1943

12. NOELL. W. Ueber die Durchblutung und die Sauerstoffversorgung des Gehirns VI. Mitteilung : Einfluss der Hypozaeure und Ansaeure, 247, 553-575, 1943

Papers in press

13. NOELL. W : Wiederbelebenszeit und Ueberlebenszeit des Gehirns bei Anoxie, Arch.Psychiatrie.

14. NOELL.W: Ueber die Blausaeurewirkung auf das Gehirn im Vergleich zur Hypoxaemie, Arch.Psychiatrie.

15. NOELL. W. : Der Einfluss von Kaelte und Waerme auf das Elektrenkephalogramm, Arch.Psychiatrie.

16. KORNMUELLER A.E.: "Elektrenkephalographie ". Handwoerterbuch d. Luftfahrtmedizin.

17. NOELL W: " Hoehenkraempfe ". " Paradoxeffekt der Sauerstoffgabe." Handwoerterbuch der Luftfahrtmedizin.

18. NOELL W.: Ueber den Einsatz der hirnelektrischen Untersuchungsmethode in der Luftfahrtmedizin. Festschrift fuer den Chef des Wehrmachtssanitaetswesens.

19. G. ETTNER. R.: Ueber das Verhalten des optokinetischen Nystagmus bei akuten Sauerstoffmangel.

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111. Studies in progress :

20. NOELL.W.: Die Sauerstoffmangelwirkung auf subcorticale Systeme auf Grund elektrenbelographischer Untersuchungen

21. KORNMUELLER. A.E. und NOELL.W.: Ueber die Vulnerabilitaet verschiedener Hirngebiete bei Hypoxamie.

22. KORNMUELLER A.E. und NOELL . W.: Ueber die bioelektrischen Phaenomene bei Hyperventilation und ihre Abhaengigkeit von der Sauerstoffversorgung.

23. NOELL. W.: Ueber den Einfluss der Liquordrucksteigerung auf die Durchblutung des Gehirns.

24. GREITER J: Hirnelektrische Untersuchungen bei Kranken mit Commotio cerebri.

25. KORNMUELLER A.E.: Hirnelektrische Untersuchungen bei Folgezustaenden nach Gehirnverletzung.

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Appendix 8.

List of reprints by Dr. F. Palme and co-workers, in Dr. Strughold's Laboratory

BEIGEL, A., HAARSTRICK, R., and PALME , F: Untersuchung der Hirnaktionsstroeme nach Sauerstoffatmung in verschiedenen Hoehenlagen, Luftfahrtmedixin, 7 : 305 - 318, 1942.

BEIGEL, A., HAARSTRICK, R. and PALME, F: Hoehenumstellung (Hirnaktionsstroeme) nach Unterbrechung der Sauerstoffzufuhr, Ibiden, 7 : 319 - 334, 1941

DUNKER, E.,and PALME, F: Die Bedeutung verschiedener Formen willkuerlicher Hyperventilation bei normaler und herabgesetzter Sauerstoffspannung in der Einatmungsluft, Ibiden, 8 : 381 - 403, 1942.

OPITZ, E., and PALME, F : Darstellung der Hoehenpassung in Gebirge durch Sauerstoffmangel, III Mitt.: Graduierung der Hohen Krankheit durch das Electroencephalogram, Pfluegers Archiv fuer die gesamte Physiologie des Menschen und der Tiere, 248 : 330 -375, 1944.

GRUETERING, F., OPITZ, E. and PALME, F: Darstellung der Hoehenanpassung im Gebirge durch Sauerstoffmangel, IV. Mitt.: Steigerung der alveolaren Hoehenfestigkeit untersucht am Schriftbild, Pfluegers Archiv fuer die gesamte Physiologie des Menschen und der Tiere, 248: 376 - 386, 1944.

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Appendix 9.

List of Serological and Immunological Papers by Dr. F. Jahnel

A. Published papers :

1). JAHNEL F : Ueber das Vorkommen positiver Wassermann- und Flockenreaktionen im Serum anscheinend gesunder Hammel, Zeitschrift fuer Immunitaetsforschung , 98 : 306 - 314,194o

2). JAHNEL F : Ueber positive Luesreaktionen im Rinderserum. Zeitschrift fuer Immunitaetsforschung 98 : 453 - 462, 194o.

3). JAHNEL F : Stark positive, nicht auf syphilis beruhende Luesreaktionen im Blute bei einer Bestimmten Erkrankung der Atmungsorgane und ihre Praktische Bedeutung, Klinische Wochenschrift 2o : 1089 - 1093, 1941.

4). JAHNEL F : Ueber positive Luesreaktionen in Blut und Liquor nach Einspritzung von artfremdem Serum, Muenchener medizinische Wochenschrift, Nr. 3o : 828. 1941

5). JAHNEL F : Ueber das Vorkommen positiver Luesreaktionen im Serum von Pferden, Zeitschrift fuer Immunitaetsforschung, 99 : 451 - 459, 1941.

6). JAHNEL F: Neuere Untersuchungen ueber die Pathologie und Therapie der syphilogenen Erkrankungen des Gehirns und Rueckenmarkes (Lues cerebrspinalis, Lues cerebri, Lues spinalis, Tabes), Fortschritte der Neurologie, Psychiatrie und ihrer Grenzgebiete : 13 : 375 - 398, 1941.

7). JAHNEL F : Die progressive Paralyse und die syphilitischen Geistesstoerungen, Fortschritte der Neurologie, Psychiatrie und ihrer Grenzgebiete, 15 : 99 - 130, 1943.

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B. Unpublished reports :

6). JAHNEL F : Serologische Besonderheiten des Malariablutes. Forschungsauftrag, Tgb.Nr. 5077/44. Bezug : HSJn/44 VIGJb v. 5.9.44, 16.9.44.

9). JAHNEL : Erforschung der verschiedenen Eigenschaften von Rueckfallfieberstaemmen zwecks Gewinnung naehrer Einsicht in die Genese des Rueckfallfiebers und anderer Spirochaetoninfektionen. Forschungsauftrag, Tgb.Nr. 5977/44. Bezug : HSJn 5913/44, VIGJb v. 5.9.44. 16 September 1944.

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NEUROPATHOLOGY AND NEUROPHSIOLOGY, INCLUDING ELECTRO-ENCEPHALOGRAPHY, IN WARTIME GERMANY

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NEUROPATHOLOGY AND NEUROPHYSIOLOGY, INCLUDING ELECTRO-ENCEPHALOGRAPHY, IN WARTIME GERMANY

Reported by

LEO ALEXANDER
Major, MC., AUS
Hq. ETOUSA
20 July 1945

CIOS ITEM 24
MEDICAL

Combined Intelligence Objectives Sub-Committee
G-2 Division SHAEF (Rear) APO 413.

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NEUROPATHOLOGY AND NEUROPHYSIOLOGY, INCLUDING ELECTROENCEPHALOGRAPHY IN WARTIME GERMANY.

This report is based on investigation of the Kaiser Wilhelm Institute for Brain Research, formerly at Berlin-Buch, parts of the Deutsche Forschungsanstalt für Psychiatrie (Kaiser Wilhelm Institut) in Munich, the Physiological Institute of the University of Göttingen, and the Luftfahrtmedizinisches Forschungsinstitut of the Luftwaffe, formerly at Berlin.

The Kaiser Wilhelm Institute for Brain Research, formerly in Berlin-Buch, was dispersed to three points :

(1) Munich, where the section for anatomy and general pathology headed by Dr. H. Spatz is housed on one floor of the Deutsche Forschungsanstalt für Psychiatrie;
(2) Dillenburg in Hessen-Nassau, where the section for special pathology headed by Dr. J. Hallervorden is located in the Schloss Hotel, and
(3) Göttingen, where the neurophysiologic and electroencephalographic section headed by Dr. A.E. Kornmüller is housed in a series of rooms in Dr. F.H. Rein's new Institute of Physiology at the University of Göttingen Medical School. The genetic section, under Dr. N.W. Timoféeff-Ressovsky, remained in Berlin-Buch. The director of the entire organization of the Brain Research Institute is Dr. H. Spatz, who succeeded its founder, Dr. Oscar Vogt, before the war. Dr. O. Vogt himself, after his retirement from the Institute, built a small Institute for himself in Neustadt im Schwarzwald, where he is said to continue his research work with much of his old vigor unaffected by his present old age. During the war, the facilities of the Institute were in part taken over by the Army and Luftwaffe Medical Corps; some of the professional personnel were commissioned either in the Luftwaffe or the Army, and after brief assignments elsewhere, in part designed to acquaint them with the military problems of their specialty, in part due to administrative error, were, in 1940, directed back to the Institute as its military-medical staff. This system pervaded all the departments of the Institute. These military sections of the Institute were integrated as the "Aussenstelle für Gehirnforschung des Luftfahrtmedizinischen Forschungsinstituts der Luftwaffe", under Oberfeldarzt Dr. H.Spatz, Air Force, and the "Aussenstelle der Militärärztlichen Akademie zur Erforschung der Kriegsschäden des Zentralnervensystems", under Oberfeldarzt Dr. Patzig, Army Medical Corps. However, Army and Air Force doctors were represented in all departments. In the electroencephalographic department, for instance, Kornmüller was

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commissioned in the Army, Noell in the Air Force. The German pathologist, Oberfeldarzt Professor Schürmann (who was killed in action) is credited with having worked out this system of utilizing existing scientific institutions by infiltrating them with military personnel, and leaving the former civilian directors in charge. Additional personnel on short or long assignments was added from the Army and Air Force. In 1940 the medical-scientific personnel of the Institute numbered 16, of whom 14 were members of the permanent staff. Three of these worked for the Luftwaffe, 5 for the Army, and 6 continued their civilian projects. There was a gradual growth until 1943, when the total medical-professional personnel numbered 26 (16 of them permanent staff members); of these 10 were Air Force personnel, 6 Army personnel, and 10 civilians. From 1943 on, personnel diminished again. The names represented in this turnover of personnel are listed in Appendix 1. There was, in addition, a large technical and secretarial staff, some of whom were supplied by the Army and Air Force. The total annual expenditure, including salaries, amounted to 300,000 Reichsmarks, most of which came from the original endowment of the Institute (275,000 Reichsmark per annum). These figures do not include the personnel and the expenditures of the genetic section, the administration of which was separate from the rest of the Institute.

The brain of any member of the Luftwaffe, on whom an autopsy was performed, or who was killed from whatever cause with the exception of anoxia, anywhere within the jurisdiction of the German armed forces, was sent to Dr. Spatz's section, while the other organs were sent to Professor Büchner at the Pathology Institute of the University of Freiburg. The brains of those who died from anoxia were likewise sent to Büchner. This policy was carried out, of course, within the natural limitations of feasibility and convenience. In actual practice, the relative number of autopsies performed in fatal casualties and the number of brains sent for examination declined from the latter part of 1942. Similarly the brains from the Army's autopsy material were sent to Dr. Hallervorden's special pathologic section, while the other organs went to the Militärärztliche Akademie in Berlin. There was a policy of liaison and exchange of material and information between all these echelons, which in practice, however, existed only on a very limited scale.

1. <u>The anatomical and general pathology section of Dr. Hugo Spatz, of the Kaiser Wilhelm Institut für Hirnforschung</u>.

The present staff of Dr. Spatz, in addition to a small technical and secretarial staff, consists of two of his

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associates, Dr. R. Lindenberg, Stabsarzt der Luftwaffe, and Dr. Link, likewise Stabsarzt der Luftwaffe. Dr. Spatz and his associates were very cooperative in giving information and in demonstrating the material in their possession. During the war Dr. Spatz and his associates studied 3,338 brains from Luftwaffe sources; 1,982 were closed blunt injuries, 1,356 open wounds, such as gunshot wounds and wounds from high explosive missiles. While all were carefully studied and described in the gross, not all were studied microscopically. Nevertheless the microscopic study of a considerable number has been completed. Part of the remaining gross material was not evacuated to Munich but remained in Berlin. Dr. Spatz not only discussed and demonstrated his findings in detail, but also placed at my disposal a collection of reprints and a complete index, arranged according to subject matter, of his own publications and those of his associates, as well as unpublished summaries of the results of his studies and research, which had been submitted to the Air Force authorities, and a set of representative illustrated protocols. The unpublished papers include the following typewritten manuscripts :-

(1) "Prinzip der Organization der Forschungsarbeiten am Kaiser Wilhelm Institut für Hirnforschung, Berlin-Buch, während des Krieges".
(2) "Pathologische Anatomie der gedeckten und offenen Gehirnverletzungen, 17-5-1944. Richtlinien. Oberfeldarzt Prof. Spatz.
(3) "Vortrag auf der Arbeitstagung der Beratenden Ärzte, 17.5.1944: Die pathologische Anatomie der gedeckten und offenen Hirnverletzungen". Von Oberfeldarzt Prof.Spatz.
(4) "Im Gehirn liegt die Führung: 30 Jahre Kaiser-Wilhelm Institut für Hirnforschung", von Professor H. Spatz, Direktor des Kaiser Wilhelm Institutes für Hirnforschung.
(5) "Aus dem Gebiete der Gehirnpathologie mit besonderer Berücksichtigung der Luftfahrtmedizinischen Belange. Für die Festschrift für den Chef des Wehrmachtsanitätswesens, 22.9.1944, Oberfeldarzt Prof. Spatz.
(6) "Von dem Zielen des Kaiser Wilhelm Institutes für Hirnforschung, Berlin-Buch, Denkschrift an die Generalverwaltung der Kaiser Wilhelm Gesellschaft".

Microfilms of these papers will be turned over to the C.I.O.S. secretariat.

Of the findings obtained by Dr. Spatz and his collaborators, the following are of interest:

The group of <u>closed blunt injuries</u> are characterized by a relatively low velocity and a relatively broad plane of

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impact, which is therefore transmitted to the contents of the skull. Careful study of the location of the contre-coup injuries thus produced showed that they involved particularly those parts of the brain which were near the bone and poorly covered by the spinal fluid cushion, i.e. especially the basal parts of the brain.

From these findings Dr. Spatz (Appendix 2, No.1,and unpublished material) and his co-workers concluded that in these types of injury the impact probably displaced spinal fluid underlying these areas. It was felt that this spinal fluid could only be displaced toward and through the foramen magnum. They further concluded that this displacement of spinal fluid on its way to the foramen magnum produces a compression wave which in passing exerts pressure on the brain stem. Dr. Spatz and his group accept this chain of events as the probable cause of the symptom complex commonly known as "cerebral concussion" or "commotio cerebri". This compression wave usually leaves no anatomical traces in the brain stem, but may cause some disturbances due to traceless changes ("spurlose Vorgänge"). Duret's haemorrhages were not constantly observed.

Dr. Spatz stressed that fact that in cases of post-traumatic syndrome, "brain stem symptoms" frequently manifest themselves clinically, without demonstrable brain stem lesions being found at autopsy. To him this fact emphasises the existence and importance of traceless events in the brain caused by trauma, ("spurlose Vorgänge"), that is, changes for which no anatomical substratum has yet been found with present day methods.

Stress is laid on the frequency of lesions at the basal aspect of the cerebral hemispheres, particularly of the orbital part of the frontal lobes following such blunt injuries. One of his co-workers, Welte, found remnants of basal contusion of the brain in 2½% of 2,000 cases derived from consecutive autopsy material of a civilian neuropsychiatric hospital. Such old injuries were occasionally found as accidental findings in flying personnel, and may have to be considered as a possible cause of aircraft accidents, such as for instance, in a pilot who died from severe internal injuries after his aircraft suddenly crashed from 100 metres altitude for unexplained reasons. In this case extensive cortical scars at the basal surface of the left temporal lobe were found (Figs 1a and 1b). These scars were sustained in an automobile accident three years earlier, which had caused obvious disturbance of only 6 weeks duration.

The group of <u>open penetrating injuries</u> are characterized by the fact that they were inflicted by high speed

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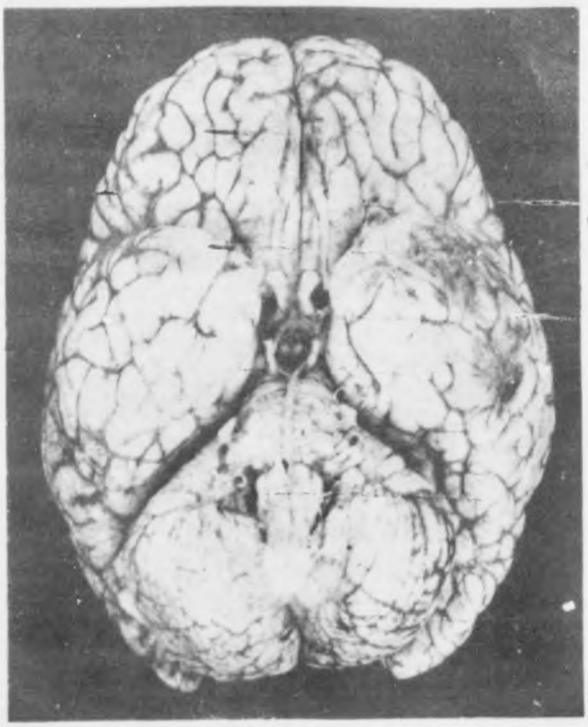

Figure 1a.
Case Luk 28 - 40.
View of brain from below. Note extensive cortical scars at basal surface of left temporal lobe.

Figure 1b.
Case Luk 28-40.
Detail view of traumatic scars of left temperal lobe.

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missiles of sharp cutting or shattering type, which acted with relatively great velocity upon a relatively small plane of impact. Thus an intense impact is exerted upon a relatively small area. For this reason the damage usually remains localized and is not transmitted to any large extent, so that contrecoup injuries do not usually occur in this type of injury.

The injuries produced by blunt force were roughly divided into 6 groups, depending upon the location from which the blunt force originated: 1. from behind, 2.from the front, 3.from the left, 4.from the right, 5.from above, 6.from below. By grouping these injuries according to these categories, it was found that the distribution frequency differed from that of injuries suffered in times of peace. While in peace most head injuries from blunt force are inflicted from behind, and only 5% from the front, in war-time Luftwaffe material 75% of the injuries were inflicted from the front, because of the crash of the head against the aircraft instrument-board in accidents. Consequently basal orbital lesions are more frequent in this material. These lesions, although causing no pathological neurological signs and symptoms apart from olfactory disorders, are bound to give rise to personality disorders of the orbito-frontal type. Dr. Spatz said that Dr. Tönnis, the neurosurgeon, had a clinical material, amounting to several hundred cases, with character changes produced by bilateral frontal injuries. The various morphologic types of lesions caused by these injuries from the front were specially reviewed by Peters (Appendix 2, No.5).

In blunt closed injuries from the right the contrecoup injuries are usually on the left; therefore organic symptoms especially those referable to the speech areas are more frequent in this group than in the group of blunt closed injuries from the left. The lesions in the group of injuries sustained from above are similar to those from behind. In the group of injuries sustained from below, cerebral cortical contusions are very rare, because the convexity of the brain, which is the site of the contrecoup impact in this type of injury, is amply cushioned by spinal fluid.

As to the histopathologic development of the lesions, both in the closed and open groups, the haemorrhages were considered to have developed immediately under the influence of the impact itself, and are not regarded as in any way necessarily connected with subsequent vascular disturbances such as had been assumed by Ricker. However, it was found that underlying the original direct lesion, within 2 days after the trauma wedge-shaped areas

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Fig. 2a.

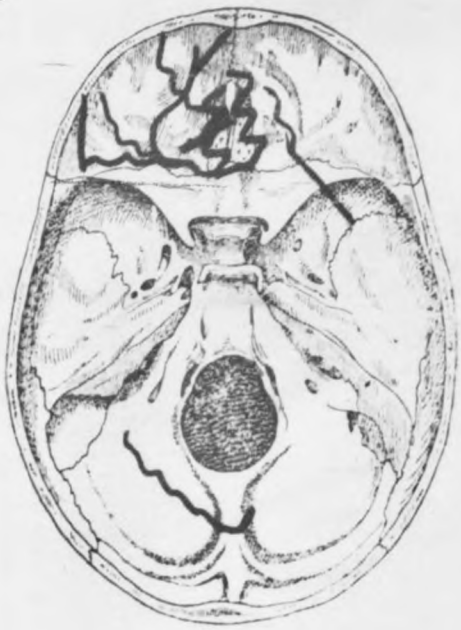

Fig. 2b.

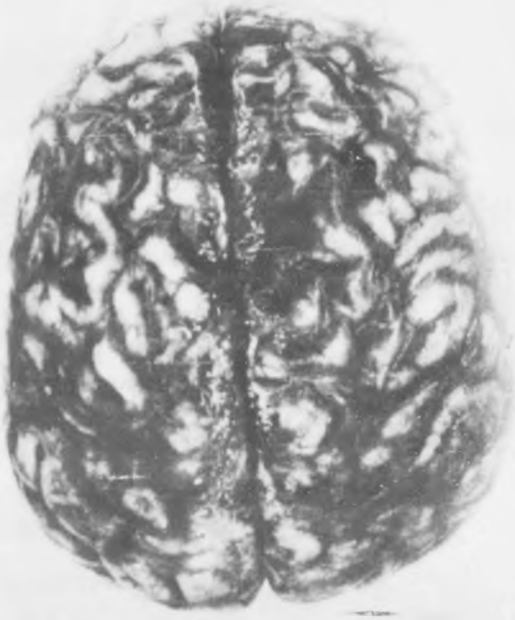

Fig. 2c.

Figure 2.
Case Luk 48-40.
Extemsive basal skull fractures (2a and 2b), and subarachnoid haemorrhage over the convexity (2c).

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Figure 3. (page 8).

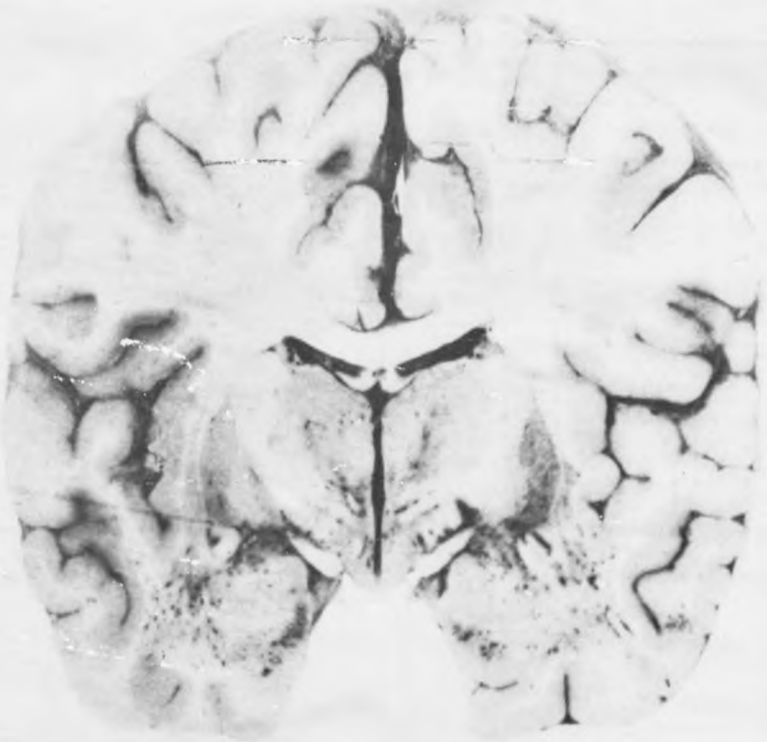

Fig.3.
Case Luk 48 - 40. Note punctate haemorrhages within the basal ganglia and temporal lobes.

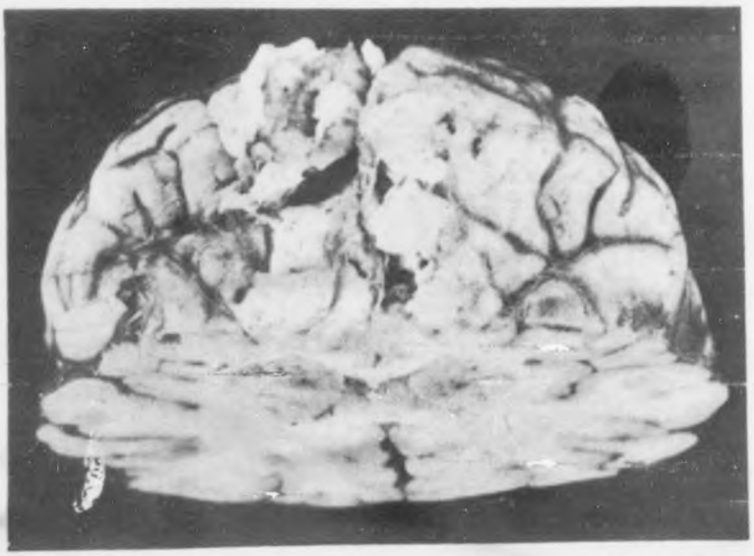

Fig.4. Case Luk 48 - 40. Note absence of haemorrhage among the extensive cortical tears at base of frontal lobes, caused by bone splinters ("Hirnzerreissung").

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of additional necrosis develop. Peters (Appendix 2, No.6), was able to reproduce similar areas in animal experiments. Spatz and his co-workers do not consider even these as wholly due to vascular disturbances, but likewise in part to a mechanical factor, which Hallervorden described as "Thixotropie" (Zbl.Neurochirurgie, 6: 37 - 42, 1941). Hallervorden, and likewise Spatz and his group, feel that the blow causes an immediate alteration of the state of the protoplasm in these areas, comparable to the liquefaction of gels. Owing to irreversible alteration of the state of the protoplasm, this focus of contusion then gradually degenerates. Its wedge-shaped form is explained entirely by mechanical factors associated with the convolutional pattern of the brain since it is of different shape in the brain of lissencephalic animals. It is regarded as important that the area of accessory necrosis caused by the blow is not outlined until two days have elapsed, because in open injuries this area of additional necrosis may become a source of infection.

In studies of the final results of the traumatic lesions, the following topographic and morphologic characteristics were regarded as indicative of the traumatic origin of a given lesion:

1. The location of the lesion at the summit of the convolution, while the valleys are spared.

2. The wedge-shaped form of the underlying accessory necrosis.

3. In large foci concrescence with the meninges.

Among the traumatic brain changes encountered in this material, one new group stands out; it is characterized by extensive brain tears caused by bone splinters ("Hirnzerreissung", Peters Appendix 2, No.5), which are characterized by the curious fact that they never bleed. This was illustrated to me by an instructive case of a 19-year old enlisted man who died in an aircraft crash. There were extensive fractures of the skull, especially of the base (Figs 2a and 2b), and while there were extensive subarachnoid haemorrhages (Fig 2c) and punctate haemorrhages within the basal ganglia and the temporal lobes (Fig 3), no haemorrhages were seen within the extensive traumatic lesions caused by the bone splinters at the base of the frontal lobes (Fig 4). Spatz and his co-workers stated that they convinced themselves that these tears occurred ante mortem. One of the collaborators Krücke, in a paper in press at present (Appendix 2,No.21), found fat embolism of the lungs in 31% of fatalities due to aviation accidents, and fat embolism of the brain in 25%.

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Unilateral oedema of the brain, a complication, particularly, of open head injuries with infection or haemorrhage, was found to express its presence clinically by dilatation of the homolateral pupil (mydriasis).(E.Welte, Appendix 2, No.11), which was found to be due to compression of the homolateral oculomotor nerve by the swollen uncus hippocampi. Figs 5, 6 & 7 illustrate this fact in a representative case of a soldier injured by a shell fragment in the right parietal area, (Fig.5) which caused depression of bone fragments and severe haemorrhage into the right parietal lobe (Fig 6). There was no prolapse because the opening of the skull was obliterated by impacted bone fragments; but marked oedema of the right hemisphere developed (Fig.6), which is seen to flatten and compress the right oculomotor nerve. (Fig.7). The soldier died on the sixth day following the injury. Clinically, there were motor aphasia and marked dilatation of the right pupil, later increasing drowsiness and slight stiffness of the neck. His right leg had to be amputated because of an additional injury.

In 75% of those patients who died from penetrating wounds of the skull, meningitis was found. Noetzel (Appendix 2, No.8), states that this figure is identical with that obtained in representative samples during the last war, which varied between 70% - 80%. He adds that during the last war 54.7% of all cases of penetrating wounds of the brain developed meningitis, with death resulting in 37.7%. According to figures given by Tönnis (see report on German military neuropsychiatry and neurosurgery) in this war only 15% developed meningitis, causing death in 12%. Noetzel (Appendix 2, No.10), also studied the extension of superficial inflammatory lesions into the brain,(abscesses, encephalomyelitis, pyocephalus internus) in human traumatic material as well as in experimental material in animals. A special study of 400 cases revealed that ventricular infection was frequently secondary to the surgical intervention. In 50% of his meningitis cases, Noetzel found subdural empyema which was found to be secondary to subdural haemorrhage (Appendix 2, No.9). In a number of cases these subdural empyemas were of extremely large size (Fig.8)

The problem of subdural haemotoma was reinvestigated by Link, who made a valiant though unconvincing effort to differentiate between traumatic subdural haematoma and presumably non-traumatic pachymeningitis haemorrhagica interna in 1,000 cases.

On the whole a close liaison with Dr. Tönnis' neurosurgical organization was maintained since 1937. Dr.Tönnis,

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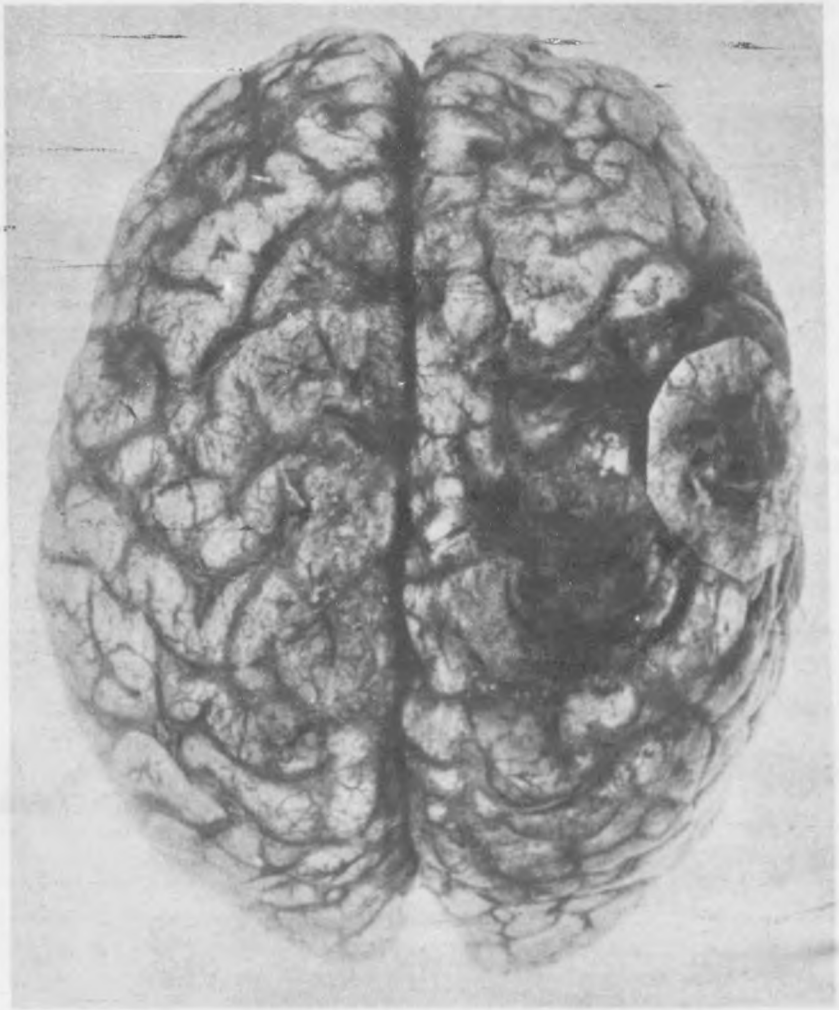

Figure 5. Case L 199. Injury of right parietal lobe due to shell fragment.

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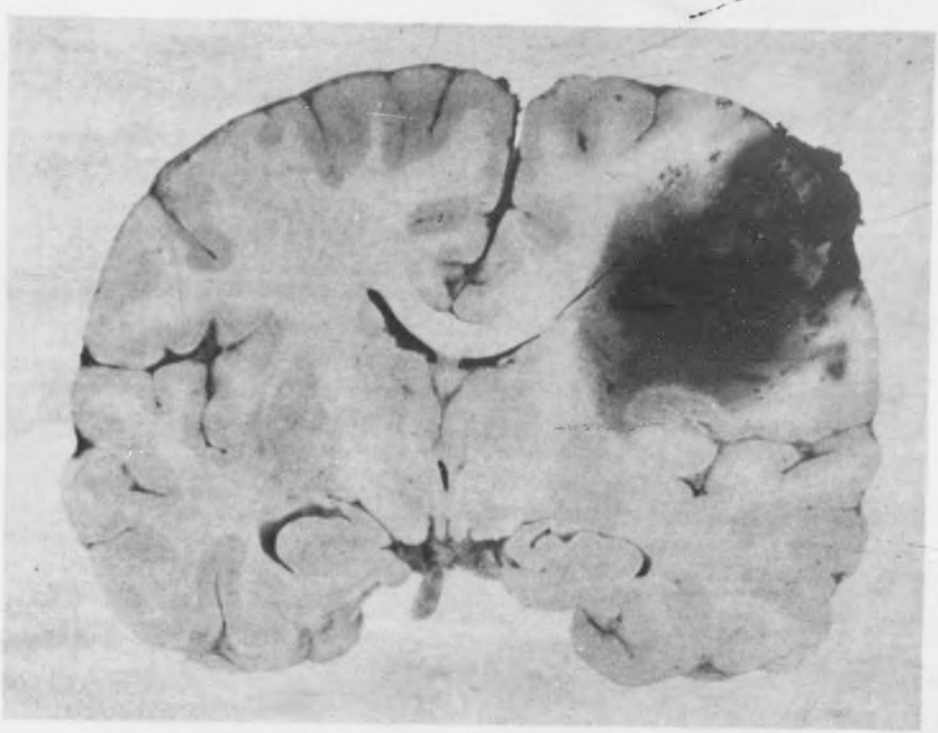

Figure 6. Case L 199. Note depressed bone fragments and haemorrhage in lesion of right parietal lobe, and edema of right hemisphere.

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Figure 7. (Page 9)

Fig.7.
Case L 199. Note flattening of right oculomotor nerve due to compression by swollen uncus hippocampi of right hemisphere.

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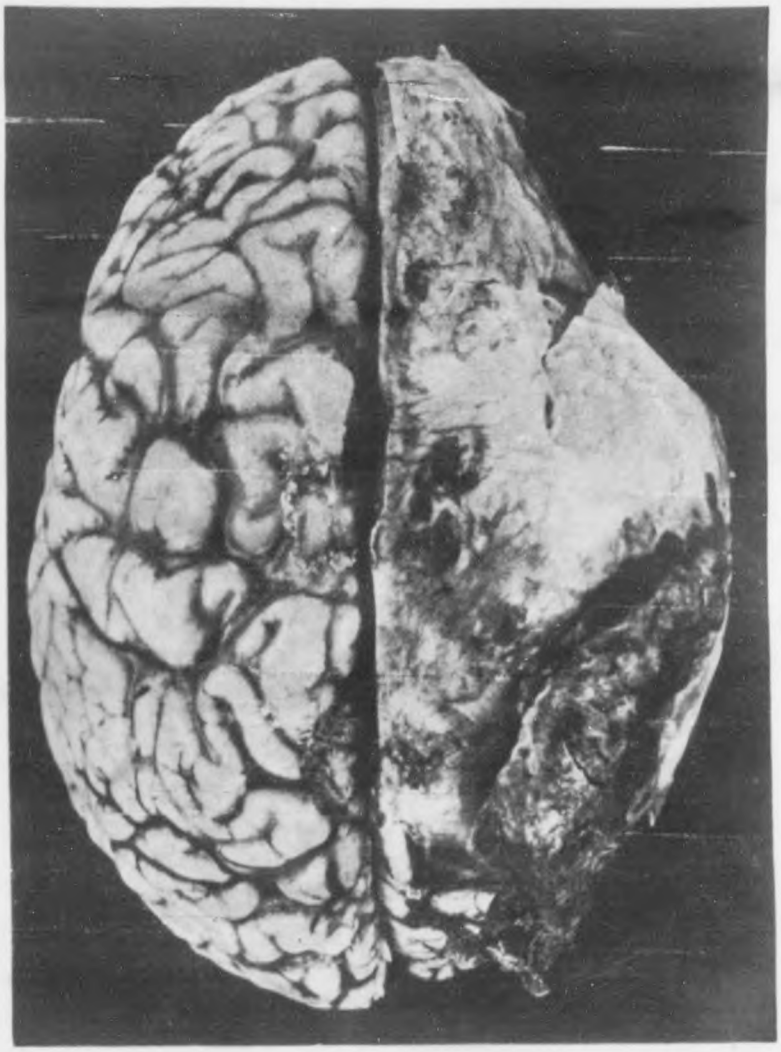

Figure 8a. Case L 152. Large subdural empyema compressing the right hemisphere of the brain.

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Figure 8b. Case L 152. Histologic section through the empyema and the underlying compressed brain.

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professor of neurosurgery at the University of Berlin before the war, was also a part-time member of the Kaiser Wilhelm institute für Hirnforschung, as director of its research sub-department on brain tumors, and experimental pathology of the brain. During the war this collaboration was extended to Tönnis' neurosurgical organization within the Air Force Medical Corps.

The availability of histologic material derived from closed and open injuries of the brain was also utilized for still unpublished studies on the differences between the symptomatic type of inflammation which occurs as a reaction to closed injuries of the brain, and the true infectious inflammation which occurs in open infected injuries of the brain.

The traumatic meningitides were also compared with a series of odontogenic meningoencephalitides (Lepp, Appendix 2, No.12). The problems of oedema and increased intracranial pressure were studied in a series of morphohistologic and physical-chemical studies (Zülch, Appendix 2, No.14; Perret, Appendix 4, No.10; Selbach, Appendix 4, No.12; and Perret & Selbach Appendix 4, No.11).

In addition to these studies in connection with war problems, studies concerning civilian problems were carried on. Dr. Spatz himself published a review of the histopathologic findings in mental diseases (Appendix 3, No.14). He and a co-worker continued research on the system atrophies of the brain, especially Pick's atrophy (K.v.Bagh ,Appendix 3,No.13; see also H.Spatz: "Über die Systematrophien und die Picksch Krankheit im Rahmen dieser Gruppe", Gegenwartsprobleme der psychiatrich - neurologischen Forschung, C.H. Roggenbau, Ed.,Berlin 1938). In addition, there were investigations of encephalitis problems as well as other types of paralysis agitans and the Parkinsonian group of illnesses (Klaue, Appendix 3, No.12), and a new group of illnesses on the border line between inflammation and tumor formations, (Blastom - Encephalitis and ependymitis blastomatosa), as well as a group of related gliomata (Schöpe, Appendix 3, No.8, T.Hazenjäger, Appendix 3, Nos. 6 and 7).

Abnormalities and changes of the carotid arteries, especially in Buerger's disease, were studied by Dei Poli and Sucha (Appendix 3, No.10) and by Charlotte Krücke (Appendix 3, No.11), who made an interesting observation by finding ossified thrombi in 5 cases of thrombosis, four due to Buerger's disease. T. Lüers prepared an inclusive study of the cerebral form of Buerger's

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disease, (Appendix 3, No.18). Becker (Appendix 3,No.5) carried out a study on the tissue changes produced by experimental occlusions of arteries and veins. Lange-Cosack (Appendix 3,No.19) presented a thorough study of the clinical and anatomical findings in a case of a special form of anencephaly in which both cerebral hemispheres were reduced to thin walled vesicles, and for which she coined the term Hydranencephaly (Blasenhirn). Reproduction of this pathologic picture in experimental animals by intraarterial paraffin injections was attempted.

Dr. Angel Pentscheff, a Bulgarian neuropsychiatrist and head of the department of psychiatry at the University of Sofia, studied cases of "Kernicturus" followed clinically by athetosis. He coined the name "encephalopathia posticterica" for this group of cases.

Dr. Spatz and his co-workers performed a series of experiments on rabbits, aimed at finding the center regulating sexual functions. They believe to have localized it in the tuber cinereum (Appendix 3, Nos.23 and 24). Among these co-workers there was a Dutch neuropathologist, Dr. Diepen, who studied the normal anatomy of the hypothalamus of the rabbit. A French medical officer, Dr. Jean Gruner, who was a prisoner-of-war in Berlin, used to come to the laboratory once or twice a week for 6 - 9 months in 1944, but did not carry out any particular research work.

Dr. Spatz and his associates, all of whom had spent varying times at the various war fronts, were also questioned concerning certain general problems of neuropsychiatric interest and about the work of other members of the institute, as well as that of related specialists in other organizations.

Concerning the neurosurgical organization they stated that the directing and policy-making powers lay - for the Luftwaffe - in the hands of Dr. Tönnis, and for the Army in the hands of Dr. Peiper, both of whom had commissions in the Air Force and Army respectively, and that they integrated all activities extending from the front line areas to the rear. At the front the work was carried out by small neurosurgical units (Sanitätsbereitschaften), which consisted of a chief neurosurgeon, 2-3 younger neurosurgeons, 1 neurologist, 1 ear, nose and throat surgeon, and one maxillo-facial surgeon, as well as a varying number of junior medical officers, all together usually 6 - 12 physicians in addition to nurses. These units usually functioned 50 kilometers behind the front, and received all injuries of head and spinal cord directly from the first aid stations. About 30 small

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planes of the Stork type were assigned to them, by which they could carry out air evacuation to the rear. However, this was frequently difficult due to shortage of gasoline and flying personnel. In the rear, the neurosurgical cases were segregated in large centers, of which Dr.Tönnis' center in Berlin, which included the Olympic Stadium as a rehabilitation center, was the largest. After the step-up of the air attacks against Berlin and the approach of the Russians, it was evacuated to Bad Ischl in Austria. Another large center was at Tutzing on the Starnberger Lake where it is still situated at present.

Electroencephalographic examinations for Army and Luftwaffe were carried out by Drs. Kornmüller and Noell, who are at present at the Physiological Institute of the University of Göttingen. The practical utilization of electroencephalography was found useful in the differentiation of organic and nonorganic illnesses, with particular reference to the flying fitness+ of air personnel following head injuries. Dr. Spatz added that Dr.Kornmüller, in addition to his other duties, also carried out confidential work on an analyzer. This was the only confidential or secret work carried out at the Kaiser-Wilhelm Institute. Administratively the Luftwaffe section of the Kaiser-Wilhelm Institute was under Luftgau 3,which was that of the 20 German Luftgaue, which included Berlin and surroundings.

In regard to Dr. Hallervorden's section, Dr. Spatz added that most of his records were taken to Schleswig-Holstein by Dr. Patzig, especially all the records on gunshot wounds of the brain in the German army. Dr.Patzig, before the evacuation of the Kaiser-Wilhelm Institute from Berlin, was, in addition to his duties at the Institute, in charge of a military hospital for gunshot wounds of the head in Berlin-Buch. In addition to the material on brain injuries in the German army, Dr. Hallervorden, and particularly one of his assistants, Dr. Eicke, also investigated a great many brains from cases of typhus. In Dr. Spatz's opinion, it is the largest collection of brains from cases of typhus ever accumulated.

No work concerning military selection was carried out in the Kaiser-Wilhelm Institute. Of outstanding men responsible for selection for the Army and Luftwaffe respectively, Dr. Spatz named Oberregierungsrat Simoneit-Berlin, Dr. Wolfgang Hochheimer - Berlin, and Dr. Luxenburger, now at the Luftwaffe Hospital in Possenhofen on the Starnberger Lake.

+FOOTNOTE: Apart from flying status, the main categories of duty status in the German Army and Luftwaffe, were:k.v. i.e.kriegsverwendungsfähig (fit for combat duty),g.v.or garnisonsverwendungsfähig(fit for garrison duty) and a.v. "arbeitsverwendungsfähig (fit for labor duty).

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As to the treatment of post traumatic disorders of the brain, Dr. Spatz stressed the fact that the best results were obtained with early therapy by means of work and athletic training. Tönnis had a particularly good set-up in regard to athletic training, competitive sports and gymnastics, since his hospital in Berlin-Reinickendorf included the former Olympic Stadium, with its facilities for water sports etc. Some of the experiences from Tönnis's clinic were published by H. Pittrich, "Übungsbehandlung Hirnverletzter" (Zbl.Neurochirurgie 7: 44-55, 1942).

As to the functional complaints, especially the neuroses, Dr. Spatz states that for therapeutic reasons the term "fatigue states" ("Überanstrengte") was preferred. Such patients were not supposed to be ill, but merely fatigued. The leading personalities in the treatment of these functional disorders were Immo von Hattingberg and Dr. J.H. Schultz in Berlin. Dr. Spatz was impressed by a report concerning their methods of treatment which was presented at a special military medical meeting. Dr.Lehmann, of whom Spatz thinks very highly, investigated these fatigue states from the viewpoint of work physiology ("Arbeitsphysiologie"). For the Luftwaffe, Dr. Spatz named Dr. Strughold in Göttingen and Dr. Luxenburger at Possenhofen as the main authorities on this subject. Spatz stated that there was no limitation of combat tours in the Luftwaffe, and that the amount of combat flying required of any individual aviator varied individually according to the stability of his nervous system.

Dr. Spatz feels that suicides in the German armed forces were fairly frequent, and he referred to Dr. Luxenburger, who, he thought, had written a paper about it.

Dr. Spatz and his associates were then asked whether any new diseases of the central nervous system had been observed by them during the war. They denied that question, but stated that a new syndrome was observed recently in patients who died from methylalcohol poisoning (most of them liberated Russian slave-workers, who mistook stores of industrial fluid containing methyl-alcohol for a potable beverage). In those cases that survived for a sufficient length of time, a selective bilateral symmetric necrosis of the putamen was observed, frequently with haemorrhagic admixture. When Dr. Spatz demonstrated these specimens to me, they appeared reminiscent of the bilateral necrosis of the putamen found by Woods and Pendleton in patients who had eaten decomposed, partly fermented corn during a famine in China. Dr. Spatz and his associates encountered no cases of epidemic encephalitis during the war.

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As for brains from the killing centers of the insane, Dr. Spatz denied that he or any other member of his Institute ever had received any. He added that the killing of the insane was done in deep secret, that nobody was supposed to know about it except SS personnel (although of course it did leak out), that consequently no scientists or scientific institutions could be contacted in order to undertake neuropathological studies, and that thus invaluable pathologic material was lost and remained unutilized.(This statement was later revealed to be in part inaccurate,when Dr. Hallervorden, who was a section chief right in Dr. Spatz's own institute, admitted having received and examined 500 brains from the killing centers of the insane).

As stated above, the genetics department of the Kaiser-Wilhelm Institute in Berlin-Buch had remained in Berlin. Its director is Dr. Timoféeff - Ressovsky, whose book "Experimentelle Mutationsforschung in der Vererbungslehre", T.Steinkopff, Dresden & Leipzig, 1937, I-X, 1-181, is well known.

2. <u>The Special Pathologic Section headed by Dr. J. Hallervorden, of the Kaiser Wilhelm Institute für Hirnforschung</u>.

Dr. Hallervorden's laboratory was visited on 14 and 15 June 1945. The laboratory was found remarkably well equipped and in full activity despite its improvised quarters. The success of the improvisation was apparently due to the fact that it was evacuated early in May 1944 because of the air bombardment of Berlin. The vast bulk of the extensive collections of histopathologic preparations, including the late Dr. Bielschowsky's collection had been brought here without mishap and are easily accessible in well ordered collection cases. The entire set-up was reminiscent of the original Kaiser-Wilhelm Institute in the Magdeburgerstrasse, Berlin, before it was removed to the sumptuous quarters in Buch. The collection consists of more than 110,000 specimens derived from 2,800 cases, in addition to several thousand specimens from the State Hospital in Görden, Dr. Hallervorden's previous location where he was succeeded by his pupil, Dr. Eicke, in addition to uncounted military cases, consisting mainly of gunshot wounds, cases of typhus, poliomyelitis etc. which had been collected since 1939. As stated above, Dr. Hallervorden's laboratory was integrated into the army as the "Sonderstelle zur Erforschung der Kriegsschäden des Zentralnervensystems", and from 1939-1943,Dr. Hallervorden held a position as civilian consultant of the army (Sonderführer) with an assimilated rank of 1st

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Lieutenant, under the military command of Oberfeldarzt Patzig who headed the army organization at the Kaiser-Wilhelm Institut. While Dr. Hallervorden has an ample technical and secretarial staff at his disposal in Dillenberg, only one of his professional associates has remained, namely Dr.Charlotte Krücke (Dr. Wilhelm Krücke's wife). His two other associates, Dr. Hugo Noetzel, Stabsarzt der Luftwaffe, and Dr. Eduard Welte, Oberarzt der Luftwaffe, were arrested as prisoners of war on 4 April 1945. Dr. Hallervorden was very cooperative in discussing all his findings, demonstrating his superb histological preparations under the microscope, and turning over a complete bibliography of all papers published from his section by himself and his collaborators. Copies of special reports which he made to the army medical authorities, covering the years 1940-1941, and 1941-1942, and carbon copies of 5 unpublished papers were placed at my disposal.

Dr. Hallervorden and his co-workers have carried out a great deal of research during the war and he has kept up his high standards as a thorough, accurate and ingenious observer. His publications and those of his co-workers, listed in Appendix 5, cover a wide range of highly interesting neuropathologic subject matter, namely: the late changes produced by cerebral oedema (Appendix 5, No.1), circulatory disturbances as the cause of congenital mental deficiencies (Appendix 5, No.2), the central demyelinizing diseases (Appendix 5, No.4), athetosis and paraballism (Appendix 5, No.5), the mucoid degeneration of peripheral nerves (Appendix 5, No.6), intracerebral calcifications and Sturge-Weber's disease (Appendix 5, No.7), histopathologic sequelae of subarachnoid haemorrhage (Appendix 5, No.8), microcephaly in twins (Appendix 5, No.9), Hallervorden-Spatz' disease (Appendix 5, No.10), myoclonus epilepsy (Appendix 5, No.11), the cerebral changes subsequent to attempted strangulation (Appendix 5, No.12), the above mentioned problem of "Thixotropie" (Appendix 5, No.13), chronic Progressive Chorea (Appendix 5, No.14), Wilson-Pseudosclerosis without cirrhosis of the liver (Appendix 5. No.15), paramyloidosis of the brain (Appendix 5,No.16), oedema and serous inflammation of peripheral nerves (Appendix 5, No.17), histopathology of neural muscular atrophy and its relationship to hypertrophic neuritis and neurofibromatosis (Appendix 5, No.18), cerebral changes caused by Trichinosis (Appendix 5,No.19), on the pathologic changes of the central nervous system in typhus (Appendix 5, No.20), on the special pathology of the substantia nigra (Appendix 5, No.21), on the general problems of encephalitis and polyneuritis (Appendix 5,No.23), and on fetal encephalomeningitis (Appendix 5,No.24). The latter was based on the study of two twin fetuses, who died two hours after their premature birth during the

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seventh month of pregnancy. The brains - which had originally been removed in order to complete an embryologic collection - showed disseminated encephalitic changes. The mother, who at one time had had a gonorrheal infection suffered from no known illnesses during her pregnancy apart from several mild attacks of sore throat.

Of particular interest are Dr. Hallervorden's annual reports. Because of their length they are not included in the appendices to this report, but they will be available as microfilms through the C.I.O.S.secretariat. In the report of 1940-1941, Dr. Hallervorden discusses his findings in typhus, on the whole along the lines of his published paper (Appendix 5, No.20). Among other infectious illnesses he mentioned a peculiar illness which he found in a French prisoner-of-war, who, in the course of an illness lasting three weeks, suffered paralysis of all extremities and became somnolent. After his death, degeneration of the entire anterolateral tract of the spinal cord and of the anterior roots was found, but the grey matter of the spinal cord and the posterior columns had remained intact. The brain showed marked protoplasmic glial proliferations and lymphocytic infiltrations throughout the parenchyma, as well as lymphocytic infiltration of the meninges. Another case is an astrocytoma of the medulla oblongata. Another interesting case is one of thrombosis of the left carotid artery which occurred in an arteriosclerotic individual who had died presumably of fright during an air raid alarm. Two other cases are sudden deaths during physical exercise, one while carrying out punitive drill, another during a march with full pack. The former had been inoculated against typhus the day before, and on autopsy showed unilateral odema of the brain. The latter showed mild perivascular infiltrations about the intracerebral blood vessels and signs of chronic meningitis.

Of particular interest was the examination of scars of peripheral nerves, which revealed amongst degenerative changes, two new types of findings, namely: a peculiar mucoid degeneration, and in older scars peculiar vascular changes which were reminiscent of those found in neural muscular atrophy, hypertrophic neuritis and von Recklinghausen's disease.

The total number of specimens studied during the year was 679. This includes 247 biopsies from brain tumors obtained as brain cylinders from punctures.

The report for 1941 - 1942 includes a detailed report of three cases of African sleeping sickness

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(trypanosomiasis), in two negroes from southern France, and one German soldier. The latter had never been to tropical Africa. He was an aviator, aged 32, who had been stationed in France. Dr. Hallervorden points out interesting differences between trypanosomiasis and dementia paralytica, which otherwise are histopathologically very similar. These differences are mainly, that in trypanosomiasis the involvement of the white substance of the brain is more marked than the involvement of the cortex, while the reverse is the case in dementia paralytica; and that among the enormous infiltrations in trypanosomiasis plasma cells are far in excess of other infiltrative cells. The clinical history of the third case, the German aviator, is interesting in that the disease, which began with a convulsive seizure followed by temporary hemiplegia, was first diagnosed as hysteria, then as brain tumor. He died a few days after his clinical picture changed into a state of somnolence with rigid gaze, bulbar speech and Parkinsonian rigidity. The latter was explained by the intensive involvement of the brain stem, the pons and the medulla oblongata found on neurohistologic examination.

Another case brought up the problem of differential diagnosis between disseminated encephalomyelitis and poliomyelitis.

A curious case is one in which the brain of a patient who died from endocarditis showed, in addition to small abscesses and softenings, another single lesion which exhibited all the characteristics of a focus of multiple sclerosis. Careful search of the brain revealed no other similar focus. In view of his rejection of the vascular theory of multiple sclerosis, Dr. Hallervorden comes to the conclusion that this must have been a rare case of a single isolated lesion of "multiple sclerosis", this postulating that two diseases co-existed in this patient.

In 30 cases of tetanus, of which studies of 14 only were fully completed, only one case with morphologic abnormalities of the brain, consisting of slight lymphocytic meningitis was found. In four cases, the peripheral nerves showed slight neuritic changes. In 11 cases of arsphenamine reaction, the usual oedema and punctate haemorrhages were seen. Dr. Hallervorden pointed out the differences in this type of reaction from those found in genuine encephalitis.

180 cases of blunt cranio-cerebral injury were studied. These cases were divided into four groups: those in which death occurred within the first two hours; those

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in which death occurred between 2 - 5 hours; those in which death occurred between 5 - 36 hours, and those in which death occurred after 36 hours. It was found especially in the 36-hour and 3-day groups that the degree of tissue reaction found in different cases of identical duration varied a great deal. When these differences were correlated with the general state of the patient, it was found that the tissue reactions were less marked in those cases in which there was the most severe degree of shock, especially associated with fat embolism of the lungs, multiple fractures, rupture of the liver with intra-abdominal haemorrhages, or with marked blood loss of other etiology. The conclusion was arrived at that the intensity of tissue reaction on the part of glial and mesodermal elements in the brain depended upon the general physical condition of the patient.

226 cases of gunshot wounds of the brain were examined. These cases were likewise divided into four groups: those in which death occurred during the first two hours; those in which death occurred between 2 - 12 hours; those in which death occurred between 12 hours and 5 days, and those in which death occurred between 5 days and 31 months. The first and second groups included those in which there was the most intensive destruction of brain substance, and in which the destruction of brain substance and its immediate after-effects were the main cause of death. Meningitis as cause of death appears in the third group, and abscesses were already observed on the fourth day. The first necroses were found 14 hours, and the first softening two days after the injury. In the fourth group, meningitis predominates as the cause of death. Only in two cases, were prolapse and cerebral oedema without meningitis fatal. Other causes of death were subdural haemorrhage, internal haemocephalus etc.

Among the 52 open penetrating lesions of the spinal cord encountered among 98 cases of spinal cord lesions examined, only 50% showed histological evidence of infection. Dr. Hallervorden regards this finding as interesting because it contrasts with his experience in open lesions of the brain, in almost all of which there was histologic evidence of infection, and in the vast majority was the cause of death.

Furthermore, 118 cases of meningitis, 17 cases of gas infection, 11 cases of carbon monoxide poisoning, and 58 cases of brain tumors, were examined.

At the end of his report Dr. Hallervorden makes the observation that while pathological material of the nervous system was supposed to have been sent to him from

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all army pathological services, he noted that in actuality, only certain army groups availed themselves of his services, while other armies did not. Thus his material is representative of that encountered in certain armies only, of which he named the 6th, 17th and 2nd.

Dr. Hallervorden demonstrated microscopic preparations of his recent work to me, and discussed them with me. He stated that he had examined a total of 300 brains of patients who died from typhus. 200 of those came from the Jewish hospital in Warsaw. On the whole, he confirmed Spielmeyer's findings on the cerebral changes in this condition. The cortical degenerative changes found were early ones,"rather in the stage in which they can be predicted than at the stage in which they are fully developed". His material included no cases in which real softening of the brain had occurred. Neither did his cases include any that had shown clinical signs of Parkinsonian type during life; although he has never seen brains from such cases, he considers them as probably due to vascular changes. The changes which Dr. Hallervorden saw in his brains consisted of the well known perivascular nodules, sometimes with necrotic center, which he interpreted as possible reactions to diapedesis of blood and plasma, similar to those found in cases of fat embolism in the white substance. In typhus, however, they occur in the grey matter exclusively. After the patient recovers from the disease these small granulomas disappear without leaving a trace, not even a glial scar. One exceptional recovered case showed a connective tissue scar. However, Dr. Hallervorden re-emphasized that no cases with neurologic residuals (especially Parkinsonian residuals) had come to histological examination. He denied that he ever received cases from concentration camps. Dr. Hallervorden at present has only the histological sections at his disposal. The gross specimens of the brains have remained in Berlin-Buch.

One of his collaborators, W. Volland, attempted to solve the question whether the parainfectious (perivenous) encephalitides are due to virus infection or due to allergic reaction. By comparing the findings in these encephalitides with those in known allergic reactions Volland, and Hallervorden himself, who supervised his work, came to the conclusion that their causation by direct virus infection is more likely. Publication of the paper was blocked by the German army because vaccinal encephalitis had been mentioned in the title. The paper had been completed on 26. 4. 1944 (Appendix 5, No.28). A microfilm reproduction of the summary of this paper will be available through the

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In a study by W.J. Eicke (Appendix 5, No.29), meningitis was found to be the cause of the destructive brain damage in 76% of 50 consecutive cases of early infantile degenerative cerebral illnesses, only the minority of which had given a clinical history of miningitis. A summary of this paper is likewise available in microfilm.

Two cases of a special type of pseudotumor, which was revealed histologically as an infectious granuloma and named "Blastomencephalitis" (Hallervorden Appendix 5, No.26) were studied. The first occurred in the course of an unexplained infectious disease, the second in a case of sinusitis. When I examined the preparations, it occurred to me that the distribution and certain aspects of the histopathologic nature of the lesions were similar to Eastern equine encephalitis, with similar topographic predilection of the pons.

Dr. Hallervorden had obtained 500 brains from the killing centers for the insane. These patients had been killed in various institutions with carbon monoxide gas. Dr. Hallervorden himself initiated this collaboration. As he put it: "I heard that they were going to do that, and so I went up to them and told them 'Look here now, boys, if you are going to kill all these people, at least take the brains out so that the material could be utilized.' They asked me: 'How many can you examine?' and so I told them an unlimited number - the more the better. I gave them the fixatives, jars and boxes, and instructions for removing and fixing the brains, and then they came bringing them in like the delivery van from the furniture company. The "Gemeinnützige Krankentransport Gesellschaft" (the "Public Ambulance Society") brought the brains in batches of 150 - 250 at a time." The man who organized this service was Dr. Hegener, a pediatrician from Berlin, whom Dr. Hallervorden remembers as a "crazy and arrogant fellow, who talked all the time about himself". "There was wonderful material among those brains, beautiful mental defectives, mal-formations and early infantile diseases. I accepted those brains of course. Where they came from and how they came to me was really none of my business". Dr. Hallervorden went on to say "this thing was a beautiful mess". In addition to all the material he wanted, all kinds of other cases were mixed in, such as patients suffering from various types of Parkinsonism, simple depressions, involutional depressions, brain tumors, and all kinds of other illnesses,

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including psychopaths who had been difficult to handle. "These were selected from the various wards of the institutions according to an excessively simple and quick method. Most institutions did not have enough physicians, and what physicians there were were either too busy or did not care, and they delegated the selection to the nurses and attendants. Whoever looked sick or was otherwise a problem patient from the nurses' or attendants' point of view, was put on a list and was transported to the killing center. The worst thing about this business was that it produced a certain brutalization of the nursing personnel. They got to simply picking out those whom they did not like, and the doctors had so many patients that they did not even know them, and put their names on the list." Of the patients thus killed, only the brains were sent to Dr. Hallervorden; they were killed in such large numbers that autopsies of the bodies were not feasible. That, in Dr. Hallervorden's opinion, greatly reduces the scientific value of the material. The brains, however, were always well fixed and suspended in formalin, exactly according to his instructions. In looking back upon that time, Dr. Hallervorden stated that he always felt slightly nauseated when another batch arrived. He was also offered brains of schizophrenics and epileptics, but these he refused - not from moral indignation - but because he felt nothing of significance would be found in them. He thinks that the cause of psychiatry was permanently injured by these activities, and that psychiatrists have lost the respect of the German people for ever. Still there were interesting cases in this material. One was a case of a severe athetoid disorder which had developed in the child of a mother who suffered accidental carbon monoxide poisoning when she was 5 months pregnant. Autopsy of the brain of the child showed bilateral necrosis of the pallidum and microgyria of the cortex. This is the only case on record in which the characteristic bilateral necrosis of the pallidum was produced by carbon monoxide poisoning of a fetus. The mother herself had suffered no lasting ill-effects from the carbon monoxide poisoning. The material also included very interesting cases of microgyria and pachygyria, as well as an unusual lipoma of the corpus callosum. The most interesting cases among this material, however, were two cases of brain tumor, both of oligodendroglioma, which developed in what appears to be direct causal connection with severe cranio-cerebral trauma. One was found in a 40-year old epileptic woman who had suffered a severe head trauma at the age of 3 years. Beneath the old skull fracture and the meningeal scar which

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still contained cellulose fibers implanted by the trauma through the open skull fracture, and attached to them, was the oligodendroglioma. The old scar and the underlying attached tumor involved the right occipital lobe near the pole. The other case was that of a boy who suffered a severe head trauma at the age of 3½ years. One year later he developed petit mal attacks, later grand mal attacks. He was killed in one of the killing centers at the age of 13 years. Autopsy showed an oligodendroglioma which involved the splenium of the corpus callosum and an adjacent part of the left ammons-horn. This tumor lay underneath a meningo-glial scar, which still contained blood pigment in scavenger cells. The original injury which is supposed to have given rise to the adjacent tumor formation was obviously a contusion of that part of the brain against the adjacent falx and tentorium. A copy of the manuscript of this important paper (Hallervorden, Appendix 5 No.25), which is still unpublished, will be available in microfilm at the C.I.O.S. secretariat. Other cases in Dr. Hallervorden's collection included three new cases of Hallervorden-Spatz disease with involvement of the substantia nigra and the pallidum, a case of Pelizaeus-Merzbacher's disease with calcifications that involved the blood vessels, a case with multiple oligodendrogliomata, and a number of striking cases of encephalomyelitis concentrica of which excellent stained specimens had been prepared. Dr. Hallervorden has written a new paper on the general problems of multiple and concentric sclerosis on the basis of these new cases (Appendix 5, No.27), the full paper being available in microfilm. Other new findings include an atypical case of diffuse sclerosis with giant cell infiltrations, and another case of diffuse sclerosis with amyloidosis of the larger intracerebral blood vessels.

3. <u>The Physiologic and Electroencephalographic Section headed by Dr. A.E. Kornmüller of the Kaiser Wilhelm Institut für Hirnforschung</u>.

Dr. Kornmüller's laboratory was visited on 16 June 1945. I prepared myself for this visit by the study of Dr. Kornmüller's recent book (Appendix 6, No.26), which had been put at my disposal by Dr. Spatz in Munich, and by the study of two confidential reports covering the period 1940 - 1941 and 1941 - 1942, which had been submitted to the Army and Luftwaffe authorities, and copies of which I had found in Dr. Hallervorden's files; as well as of a review of the activities of the physiological and encephalographic section submitted to the

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army authorities by Kornmüller's collaborator, Dr.Noell, which had also been shown to me by Dr. Spatz. Copies of the book, as well as the three reports will be available in microfilm at the C.I.O.S. Secretariat.

In studying the book, my particular attention was aroused by a chapter on fatigue (pages 36 - 42) which describes findings which were new to me. Choppiness and discontinuity of alpha waves as well as the appearance of slow waves in the frontal lobes were regarded as characteristic in acute and in chronic states of fatigue. The remainder of the book, which is well written and well illustrated, contains findings which were in principle not new to me because similar ones had been obtained in independent studies by the leading American and British electroencephalographers.

The annual report 1940 - 1941 stated that the total number of electroencephalograms examined during the year was 523. Dr. Kornmüller claimed that he was able to demonstrate electroencephalographic correlates of the symptoms of fatigue and easy fatigueability complained of by patients suffering from post-traumatic syndromes. The characteristic signs were discontinuity of alpha-rhythm, slow waves, and upon opening the eyes, not the usual inhibition, but activation of the alpha waves.

In closed traumatic lesions with focal symptoms, he found focally circumscribed areas of reduction of alpharhythm, one at the site of the original trauma, but usually a more marked one at the diagonally opposed region of the head, presumably the site of the contre coup. This was quite characteristic in patients who had suffered cerebral contusion. In cases who had suffered open injuries of the brain, the electroencephalographic abnormalities were restricted to the region of the scar and its immediate surroundings. In these cases abnormally low frequencies were most striking. Low frequencies were found generalized over the entire brain after severe injuries. In those cases in which such generalized disturbances of cerebral electroactivity were found a long time after an injury they were regarded as indicative of internal hydrocephalus or other increase of intracranial pressure.

The frequent finding of slow waves over the frontal lobes in post-traumatic states was considered as being actually caused by a traumatic disturbance in the brain stem (inter-brain). This finding usually suggested an increased proneness to seizures, but it was also frequent in patients who complained about dizziness.

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Causes of traumatic epilepsy were specially studied and divided into three groups: those in which the constitutional basis was paramount; those in which exogenous damage had caused a purely focal epileptogenic region at the site of the injury; and those in which there was a combination of these two factors, usually combined, in addition, with functional disorders which were presumed to be due to disturbance of the hypothalamus.

Dr. Kornmüller makes the statement in this report that he regards the electroencephalographic examination as important in the appraisal of patients in whom no other objective changes can be demonstrated, not only in cases of brain injury but also in other nervous illnesses occurring in the armed forces. Of particular interest was a series of re-examinations of patients with brain injuries which he performed together with Dr. Götze of the Luftwaffe-Lazarett, Berlin. The following signs of improvement were found: 1. The disappearance or reduction in size of the focal areas of reduction of alpha activity; the return of the slow frequencies to normal, and 3: a resynchronization of previously asymmetric discharges, especially in the frontal lobes. Dr. Kornmüller states that it is considered possible that electroencephalographic examination could be helpful in the differential diagnosis between cerebral contusion and cerebral concussion.

Another set of studies concerned the changes of the brain waves produced by acute severe anoxia, and he considered the possibility that the individual differences encountered in the varying resistance of the brains of different individuals against the effects of anoxia could be made into a test for the selection of flying personnel, particularly for high altitudes. Dr. Kornmüller's report ends with a practical suggestion, derived from a study in which he found that the cerebral disturbance caused by anoxia is further increased by the simultaneous lack of CO_2 leading to an additional hypocapnia. Based on this observation, Dr. Kornmüller makes the suggestion that at high altitudes not pure oxygen, but O_2 - CO_2 mixtures should be administered.

The report of 1941-1942 stated that during that year a total of 747 electroencephalographic examinations had been made, and that the electroencephalographic examinations of patients was utilized for diagnosis and for the evaluation of the duty status of patients. With regard to his findings concerning fatigue-states, Dr. Kornmüller was more outspoken than he had been the previous year. He stated that patients suffering from

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post traumatic states, and also other patients with certain "vegetative disturbances" without previous trauma, usually presented a characteristic electroencephalographic picture. This picture consisted firstly in symmetric slow waves over the anterior parts of the brain. Furthermore, such cases were characterized by the fact that the disturbances caused by brief hyperventilation outlasted the hyperventilation for some time. Dr. Kornmüller added, that he has made therapeutic trials with inhalation of CO_2 in those patients. Dr. Kornmüller came to the following definite conclusion: "The fatigue states which occur frequently following head trauma, as well as the fatigue states and over-fatigue states of aviators (flying fatigue) are characterized by well defined electroencephalographic findings."

In certain cases following head trauma, Kornmüller found abnormal discharges similar to those in epilepsy which were interpreted as an incipient increased proneness to seizures, and an indicative sign of developing traumatic epilepsy. A special chapter in the report dealt with the "paradoxical effect of oxygen administration", a phenomenon occurring in certain predisposed individuals, on which studies were later published by Noell, Kornmüller, Gremmler, Schneider and Roeder, (Appendix 6, No.20; Appendix 7 No,1; Appendix 7,No.8). Independently, during the war, this "paradoxical effect" had been observed also by American and British experts and designated "recovery effect". (I do feel, however, that the name "paradoxical effect of oxygen re-administration" is better and should be adopted).

Dr. Noell's report: "Über den Einsatz der hirnelektrischen Untersuchungsmethode in der Luftfahrtmedizin, Festschrift für den Chef des Wehrmacht-sanitätswesens", Dr. Noell states that electroencephalography is a valuable aid in the examination of patients who have suffered injuries of the brain, and for the appraisal of fitness after head injury or after states of exhaustion, especially if subjective complaints persist in spite of the fact that abnormal neurological findings are absent or slight. Electroencephalographic examination can "objectivize" these complaints, and can furthermore allow an estimate as to the degree of damage. In addition, electroencephalographic examination may uncover a focal injury, especially at the site of contrecoup, which, in view of the widespread presence of mute zones in the brain, cannot be done by clinical neurological examination, at least not with any degree of certainty. Electroencephalographic examination may also uncover an epileptogenic focus or

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at least a focus of increased seizure proneness for which the term "pre-epileptic focus" is being used. Furthermore, the report goes on to say that in most cases of fatigue state and "vegetative crisis", the electroencephalogram usually shows definite changes. Dr. Noell feels that even the degree of fatigueability can be determined by special tests in conjunction with the electroencephalogram. Further uses of the electroencephalogram include the localization of brain tumors, and clarification of the action of anoxia, CO_2, and changes in temperature upon the brain. Anoxia is defined electroencephalographically as a state of increased irritability with a simultaneous decrease of certain rhythmic activities. The final state of paralysis produced by anoxia is associated with an increased lability of those elements which still react; this is the convulsive stage. The opposite changes are produced by an increase of CO_2. A decrease in CO_2, however, for instance by hyperventilation, causes changes similar to those of anoxia. Lowering of body temperature causes a characteristic state of excitation of the cortex with increased proneness to seizure, similar to that produced by certain convulsive poisons, for instance eserin and strychnine (see also C.I.O.S. report on "Treatment of shock from prolonged exposure to cold, especially in water", which includes an interview with Dr. Noell on this subject), but unlike the electroencephalographic pictures in anaesthesia, as may have been expected from the clinical appearance. This is probably the reason for the contraindication of analeptics in shock from exposure to cold. In hyperthermia, on the other hand, the electroencephalographic picture is similar to that of anoxia.

In a special study of the effects of anoxia upon the various echelons of the optic system, it was found that the cells of the retina were much more resistant to anoxia than any other parts of the optic system. Some of these differences in resistance to anoxia were considered as due to differences in capillarization. The importance of the circulation apart from its oxygen supply was illustrated by experiments which tested the effects of anoxia with and without interruption of circulation. It was found that if the circulation is interrupted completely for 18 - 20 minutes, recovery of the brain becomes impossible, while a marked degree of recovery takes place within a few hours if the interruption of circulation is only of 3 - 4 mimutes duration. If anoxia, however, is produced without simultaneous interference with circulation (as for instance by local cyanide intoxication), these periods are significantly longer: recovery becomes impossible only after 40-60

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minutes of anoxia without interruption of circulation. Noell feels that if anoxia leads to actual collapse from mountain sickness, additional damage is caused by the disturbance of circulation incidental to such collapses.

On my visit to the laboratory, Dr. A.E. Kornmüller, who holds the rank of Stabsarzt in the Army, and his associate Dr. W. Noell, who holds the rank of Oberarzt in the Luftwaffe, were very cooperative in discussing and demonstrating their findings, opening their files for inspection, and showing a very instructive teaching film. Their published papers deal with the following subjects :
Epilepsy (Appendix 6,No.11, & No.17); anoxia and altitude sickness (Appendix 6, Nos 15, 18 and 24); the action of CO_2 (Appendix 6, Nos.19 and 23); the paradoxical effect of oxygen administration (Appendix 6,No.20, and Appendix 7, Nos 1 & 7); a general review of the interpretation of electroencephalography (Appendix 6,No.21); on pre-epileptic signs in the electro-encephalogram (Appendix 6,No.22), and on the influence of CO_2 upon the effects of anoxia (Appendix 6, No.25). The post-hypoxemic proneness of the heart to fibrillation was studied by Noell & Schneider (Appendix 7, No.9), and the inter-relationships between hypoxemia, the epileptic seizure and the convulsions of high altitude were studied by Gremmler (Appendix 8,No.7). An interesting series on cerebral blood-flow under the various conditions of anoxia, hypoxia, lowering of blood pressure, CO_2 etc. has been contributed by Noell and his collaborators (Appendix 7, Nos. 2, 3, 4, 5,6,10,11 & 12). All these papers will be available in microfilm at the C.I.O.S.secretariat.

The routine work of Dr. Kornmüller and his collaborators during the war has consisted in carrying out electroencephalographic examinations for military hospitals ("Lazarette") of all parts of the armed forces, and for "Sichtungsstellen für erkranktes fliegendes Personal" (examination centers for sick flying personnel), especially that at Halle-Dölau. Furthermore, Dr. Kornmüller was a staff member of the "Aussenstelle für Gehirnforschung(Professor Spatz) of the Luftfahrtmedizinisches Forschungs-Institut (Professor Strughold)". In the latter assignment he and his collaborators carried out experimental research. Apart from Dr. Noell, his collaborators were Dr.Joseph Grammler, Oberarzt der Luftwaffe, and until 1943 also Dr. Reinhold Grüttner, who later was assigned to Dr. Tönnis' neurosurgical center. The teaching film which Drs. Kornmüller and Noell showed me was well arranged. The first section showed the usual phenomena produced by opening and closing of the eyes, hyperventilation and anoxia. The second section showed clinical examples such as narcolepsy, focal traumatic

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lesions and petit mal epilepsy. Colonel Wright, of USSTAF had seen the film and had been given a duplicate copy which should be available through USSTAF. A special film was shown which illustrated the "paradoxical effect of oxygen administration" (our "recovery effect"). In discussing their findings on the "paradoxical effect", Drs. Korrmüller and Noell stated that when a quick change is made from hypoxia to oxygen, about 3% of all people have a momentary seizure-like reaction, rarely with complete loss of consciousness, but with changes of tonus and some psychomotor signs of confusion of a cataplectic - narcoleptic type, which begins after EEG evidence of cerebral anoxia has passed. In some individuals similar attacks could be produced by pressure on the carotid sinus. This "paradoxical effect" is absent in these individuals if oxygen is brought back gradually. This phenomenon is obviously based on a constitutional peculiarity found only in certain persons.

The electroencephalographic effects of cold temperature were discussed then; they have already been reported in a previous report (see above).

Dr. Noell carried out special studies on survival and revival times of the brain in anoxia, as well as on the comparison of the electroencephalographic changes produced by cyanide with those produced by anoxia. All this work was done on rabbits. The papers are in press in the "Archiv für Psychiatrie". As to the technique of measurement of the survival and revival times, Dr. Noell stated, that for instance if after 20 minutes of arterial clamping, during which artificial respiration had been given continuously, opening of the clamps produced traces of cerebral electro -activity, this was interpreted as meaning that the survival time was 20 minutes. After 3 minutes of clamping, however, perfect revival could be obtained. Dr. Noell stressed that the actual functioning of the cortex in its full complexity is, of course, more sensitive than its mere cerebral electro -activity. The survival time after mere local anoxia by cyanide application with intact circulation was found to be 40 minutes. According to Dr. Noell, cyanide poisoning is equal to anoxia from the electroencephalographic point of view, except that respiration is affected earlier than cortical function in cyanide intoxication, while the reverse is true for anoxia.

Special attention was paid to the survival times of the various parts of the brain. Following clamping of all cerebral vessels no differences were found in survival times between the various echelons of the optic system, namely the quadrigemenal plate, the geniculate bodies and the area striata. However, the retina was found to survive the other parts for several minutes.

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TABLE I.

Random sample of 400 cases of military personnel examined electroencephalographically at the Aussenstelle für Gehirnforschung in Berlin-Buch by Dr. A.E. Kornmüller and his collaborators.

Clinical Problem	Electroencephalographic findings		
	Negative EEG (normal)	Slight abnormalities in EEG	Marked abnormalities in EEG
Cranial trauma, closed, blunt: Concussion, Contusion Closed impression fractures 54%	44%	28%	28%
GSW (open injuries) 15%	13%	37%	50%
Tumor suspects 5%	20%	30%	50%
Epilepsy suspects 5%	5%	15%	80%
Neurotic Complaints 4%	75%	20%	5%
Fatigue syndromes 8%		"Fatigue picture", i.e. chopped alpha rhythm and 6-8 per sec. activity which disappears on sensory stimuli (knocking):	
after head injury	5%	95%	-
without head injury	30%	70%	-
Other neurological and psychiatric cases 9%	not graded as to findings obtained		

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Concerning his routine work, Dr. Kornmüller stated that since 1939, five thousand clinical patients were examined electroencephalographically in his laboratory, of whom 95% were members of the Army or Air Force. In addition, he examined 1,000 normal human beings in connection with anoxia studies and other research, especially on fatigue, and on the effect of pervitin (benzedrine, amphetamine sulfate) in normal individuals. Among the patients, repeat and follow-up examinations were performed in 18%. Dr. Kornmüller had not completed his statistical survey of his findings in the military personnel that he had examined. At my request he did a spot-check statistical analysis of a random sample of 400 consecutive cases (see Table 1). It is of interest to see in this table that among the open injuries of the head the largest group of EEGs showed severe changes, while the largest group of EEGs following closed head injuries has remained normal. It is likewise interesting that 75% of the patients with neurotic complaints (which are given as constituting 4% of the entire group) had normal EEGs. This group does not include the "fatigue syndromes". The electroencephalographic "fatigue picture" ("Ermüdungs-Bild"), is defined as consisting of "chopped" alpha rhythm, and of associated 6 - 8 per second activity which disappears in response to sensory stimuli (such as making a noise by knocking).

Although Dr. Kornmüller classifies the fatigue picture as a slight abnormality of the EEG, yet he feels certain that it is a significant abnormality. He went on to emphasize that he never made a clinical diagnosis on the basis of his electroencephalographic study of the patient, but merely described the phenomena as he observed them and submitted them to the clinician in charge of the case, who was to integrate the information supplied into the clinical picture as a whole. Dr. Kornmüller then placed his file of routine reports, which also included clinical summaries and follow-ups supplied to him, at my disposal for investigation and study. I came away from the study of these reports with a definite feeling that the very restraint used by Dr. Kornmüller in evaluating the clinical significance of his findings must have been confusing to the clinician, unless he happened to be an accomplished electroencephalographer himself, which, however, none of them seemed to have been. Dr. Kornmüller's reports merely described brain-wave pictures without attempting to evaluate the clinical significance of the changes described. The consequence was, as is quite obvious from the letters accompanying patients coming for re-examination at later dates, and the follow-ups supplied by the clinicians on those occasions, that the

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medical officers in charge of the patients eagerly seized any opportunity to utilize any degree of electroencephalographic abnormality reported as a justification to dispose of the patient as a case of organic and presumably irremediable brain damage, in preference to placing him into the therapeutically and administratively troublesome category of psychoneurosis. It becomes obvious to the reader of the routine report file, that a good many obviously quite neurotic patients were simply disposed of as cases of organic brain damage, and simply reassigned to lighter duties, e.g. ground duties without any further treatment, which otherwise would have been available, particularly in Dr. Von Hattingberg's psychotherapeutic department at Halle-Dölau whence most of the patients came, simply because some abnormal 6 - 8 per second activity of their frontal lobes was found. With all respect to Dr. Kornmüller's wide experience, demonstration of the actual brainwave records themselves by him still left me unconvinced that the occasional and slight slow wave activity which he regarded as characteristic of the chronic fatigue states had anything to do with the clinical syndromes found in these patients, especially as Hill and others have found similar sporadic 6 - 8 per second activity to be a not infrequent constitutional abnormality, especially in young people and in individuals with psychopathic trends. This, of course, in no way detracts from the validity and significance of the appearance of a significant degree of slow wave activity which occurs in severe acute fatigue states approaching sleep, and in acute anoxia. The point which I seriously question, however, is whether an analogy between these sporadic frontal slow wave patterns and the significant diffuse slow wave activity of severe acute fatigue or anoxia can be drawn. When this point was argued with Dr. Kornmüller, he himself admitted that although he personally felt certain about the justification of this analogy, proof convincing to others may still not yet be at hand; and he again re-emphasized the point that after all he never committed himself in his reports as to the definite clinical significance of these findings. In practice, however, it is quite obvious that without actually saying so his description of the slow waves and the other aspects of the "Ermüdungsbild" sufficed to make the medical officer who received the report regard the case as a purely organic problem and to prevent any further psychotherapeutic measures being brought to bear on the patient. Dr.Kornmüller turned over to me three sample reports which I considered characteristic and which I shall review briefly:

Case 1: Lt. G.S., born 1915, a fighter pilor who had flown 172 combat missions, was injured on 13 May 1940, when his plane - which had had its landing gear shot off - turned over during the crash landing. He suffered lacerations of

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the head and contusions of the left shoulder. He did not lose consciousness, did not vomit, but was unable to move and had pains in his chest and neck. There were haemorrhages and suffusions about the eyes corresponding to his aviator's goggles, and some discharge of blood from the left nostril. Spinal fluid was normal and so were X-ray examinations of the skull. The left arm remained weak for a number of weeks, the pattern of weakness being that of a radial palsy. There were no sensory changes. He was treated with lightcradle, massage and galvanic electricity which caused fairly rapid improvement of the left arm. He was transferred to a hospital near his home a month later. After a considerable period of further hospital treatment and convalescent care, under which his physical complaints improved, he began, in April 1941, to complain of increasing inability to concentrate and of disturbance of memory, although he did not feel fatigued. For this reason he was referred for electroencephalographic examination on 14 February 1942. When reporting for this examination he also complained about easy fatiguability, in addition to his inability to concentrate and loss of memory. Furthermore, he said he had become intolerant of solar heat. Now he also complained of sensory disturbance in the tips of the fingers of his left hand. The basal metabolic rate was increased by 23%. A test of circulatory efficiency performed by letting him step 30 times on a chair (obviously a test of the type of the Schneider test), produced extrasystoles. Electroencephalographic examination showed, in addition to normal waves, a number of groups of waves of lower frequency and higher amplitude, of which each burst lasted a few seconds. Hyperventilation did not increase the frequency of these abnormal discharges. On 17 April 1942, the patient was again referred for re-examination. In the meantime he had been hospitalized in a Luftwaffe hospital where he complained of constant headaches which were increased by any change of temperature, such as occurred when he left his room to go outdoors and returning to his room, by warmth, by exposure to sun rays, and by mental effort. Slight excitement, such as receiving a decoration, caused dizziness, vertigo and marked pallor. Frequent change of color of the face was observed. He stated that his ability to concentrate had improved and also his memory, byt that slight physical effort such as that incidental to firing an airgun or playing table tennis, caused marked tremor of knees and hands. He also complained of irritability. Electroencephalographic examination showed exactly the same findings as before, namely groups of waves of lower frequency and increased amplitude. Once the appearance of such a group of abnormal waves was synchronous with a feeling of absent-

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mindedness on the part of the patient. On 8 July 1942, the patient was sent for his third electroencephalographic examination, after he had been for six whole weeks at air-force rest homes in Carinthia and at the Wörher-lake, where he engaged in hunting, hiking and fishing. His headaches had improved and they were now only elicitable by prolonged sojourn in the sun. He still sweated easily but he felt much better and freer. The brainwaves remained as reported before. After further hospital treatment he was referred again on 9 November 1942. His headaches had become rare, and normal mental activity tended to bring them on much more rarely than previously. However, headaches could still be produced when he was suddenly startled or frightened. In spite of that he expressed his belief that he was ready to return to combat flying duty; but he added than whenever he flew, even at low or medium altitudes, headaches would appear. He stated that he felt a rather constant thirst. There was still marked vasolability of the face. He still seemed somewhat forgetful, and kept notes on everything he wanted to do. He felt very well as long as he did not have to do things outdoors. He could still hardly stand the sun or heat. He had become a bit more sensitive and moody than he used to be. The brainwaves at this fourth examination showed essentially the same findings as before. Brain waves of "lowered frequency" were found, "although perhaps somewhat less frequently and less definitely than before". They were regarded as "the expression of a general (vegetative?) disturbance". The control of his vegetative disturbances by Bellargal was recommended. Following this examination the patient was given a ground job. When he was re-examined on 15 February 1943, he had been doing well on ground duty, although he felt somewhat fatigued and had to put in extra rest periods. His memory had improved. He stated that when he flew in an airplane as a passenger on one occasion he developed headaches, and that at night he became easily startled and frightened when he heard the telephone ring anywhere in the building, which regularly produced an intense stabbing sensation in the head which caused a severe generalized headache for the next 5 - 10 minutes. His irritability was improved. The electroencephalographic findings were similar to those obtained at the previous examinations, except that this time hyperventilation caused a ready and persistent increase of the abnormal wave patterns. Immediately after a burst of abnormal patterns the patient said when asked how he felt "I just felt like dropping off to sleep". The report concluded that there was electroencephalographic evidence of brief states of reduced clarity of consciousness. The patient

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who had been in the meantime promoted to the rank of Captain stayed on ground duty. The patient was examined for the sixth time on 17 November 1943. His complaints had greatly improved, the only residual complaint being easy fatiguability. This time the electroencephalogram showed only occasional waves of lowered frequency which could be increased slightly by hyperventilation. Dr. Kornmüller concluded that "the findings at this examination were not as marked as before (improvement?)". The patient was sent back to his ground job.

Case 2: This patient, K.B. was a sergeant pilot who had been shot down several times in a series of very harrowing combat missions, with severe damage to his aircraft and narrow escapes. However, he never hurt his head in crashing and never suffered concussion. Since January 1943 he had occasional severe headaches on the right, especially under physical strain, long railroad journeys, etc., but no dizziness although he was easily startled and slept poorly. He lost 14½ kilos in weight, and did not respond to a period of rest at an Air Force rest home in Kitzbühel. He sweated profusely, always had moist hands and blushed easily. He was referred for electroencephalographic examination on 29 April 1943 because of easy startle and fright reaction, headaches and sleeplessness. The headaches were more severe on the right. Neurologic examination was normal. There was no history of concussion. In this case the electroencephalogram was completely normal.

Case 3: Captain E.S. This patient had lost 30 lbs during the summer of 1942 in connection with a dysentery-like febrile illness complicated by jaundice. However, he continued to do duty until October 1942, when he broke down and was hospitalized. He developed disturbance of memory and concentration and whenever he became excited, a tight feeling above the eyes which sometimes spread backwards to the neck. He was easily excited, sweated profusely, and had a general feeling of uncertainty and insecurity. He gave a history of head injuries suffered in 1936 and 1937, but there had been no unconsciousness and he had not vomited. These episodes of head trauma were not followed by significant complaints. It was considered that this patient was suffering from a slight depression which occurred after over-exertion incidental to a dysentery-like illness. There was disturbance of concentration, and irritability, but physical findings were otherwise normal. The electroencephalographic report of 15 May 1943 reads as follows: "In the anterior parts of the brain occasional waves of lowered frequency

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(8 - 6 per second), were observed bilaterally. On sensory stimulation sometimes no inhibition, or merely an incomplete inhibition of alpha activity occurred, such as is observed in fatigue".

There is no doubt in my mind that the correlation of these slight changes in the electroencephalogram with the clinical findings in, and the complaints of, these patients is highly doubtful, or unproven at best. Although the resulting labelling of this highly heterogeneous clinical material as "organic" appears to have been eagerly seized on by the medical officers in charge of these patients because it facilitated disposition and reduced the number of cases to be included in the disliked diagnostic category of psychpneurosis, it certainly prevented utilization of such psychotherapeutic facilities as were available by those patients involved, and also made the understanding of the nature, etiology and therapy of these fatigue states difficult by introducing a variable which is not necessarily etiologically significant, or rather the significance of which in connection with these fatigue states is not proven. On the other hand, Dr. Kornmüller is a man of vast experience in electroencephalography, and while his approach to the electroencephalographic correlates of the fatigue states has not progressed beyond a certain hunch, still there may be something in it which is worth further investigation. However, even then the simple labelling of the fatigue state as organic should not be the end of the story, as was obviously the practice in the German army and Air Force hospitals, but on the contrary should lead to an investigation how such obviously psychological and psychobiological factors could be operative in modifying brainwave patterns. Whatever the "fatigue pattern" in the electroencephalogram may be, it is probably not the product of an organic injury but something that is alive, changeable and modifiable, even possibly by psychologic and other therapeutic measures. This is definitely a problem for future investigation.

Dr. Kornmüller was then asked whether he had succeeded in constructing an analyzer. He replied that he had given considerable attention to this problem and had succeeded in constructing three models: Analyzer No.1. functions like a screen, a sieve, or a filter. Dr. Kornmüller calls this analyzer the "EEG filter". It filters out specific frequencies that are being sought.

Analyzer No.2 was constructed on the principle of mechanical resonance. This analyzer signals frequencies lower than 10 per second, either by flashing a light or a knocking sound. It can be adjusted to any frequencies

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looked for; for instance it can signal all frequencies lower than 8 per second, or lower than 6 or 3 per second, or any other given frequency. It does not write a spectrum; signals appear in the form of a knock or, on the graphic recording, in form of a spike. While the principle of resonance used is similar to that employed by Gray Walter for his analyzer, Dr. Kornmüller's analyser is definitely not able to record a full spectrum of cerebral electro-activity. When these differences were discussed with him, Dr. Kornmüller appeared slightly hurt at the implication that I considered Gray Walter's analyzer superior to his, and hasted to add - "something that I originally had not intended to say because nobody else asked me about it", - namely, that the purpose of his analyzer was entirely different from that of Gray Walter. Dr. Kornmüller emphasized that he was not interested in constructing an analyzer that would give a complete spectrum for research purposes, but that he was after something intensely practical that would provide a signalling machine which could signal whenever a man became inefficient either because of anoxia or because of the effects of severe acute fatigue approaching sleep, which would express itself in a significant deviation of cerebral electroactivity. Dr. Kornmüller feels that he has solved the problem of obtaining a workable apparatus of this type in his third analyzer, the size of which was reduced to that of a cigar box. The technical aspects of this intensely practical piece of apparatus were developed by an oscillograph engineer by name Prast, who is employed by the firm of Phillips, an oscillograph firm in Frankenstein, Vogtland. This is a small village located about two thirds of the way between Chemnitz and Freiberg, the map coordinates being N51/K86, GSGS 4346, Germany 1:250,000. This village is at present occupied by the Russians. All information regarding the apparatus and its whereabouts has been given to USSTAF authorities who have declared their interest in obtaining the apparatus and picking it up. Dr. Kornmüller and Mr. Prast thought that this apparatus could be used as a means of automatic signalling of "dangerous low frequencies" caused by anoxia, fatigue, or sleep in pilots of air - craft or drivers of automobiles. The device is set to signal all frequencies lower than 8 per second, irrespective of exact frequencies, and the apparatus is so designed so as never to respond to frequencies above 8 per second. This is indeed an ingenious device which has wide applicability. In large bombing aircraft, for instance, a signalling device could be installed on the instrument board which would inform the pilot whether any member of his crew, who could be hooked up to a

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central apparatus by one lead each from their flying helmets, was falling asleep or becoming anoxic. This would allow the pilot to have complete awareness of the state of alertness of his gunners and other crew members. On the other hand, in peacetime the apparatus could be used to prevent the driver of an automobile on a long cross-country run from having a serious accident because of his falling asleep. As soon as the brainwaves slowed down at the approach of sleep, the apparatus could set off an alarm system which would succeed in waking him up.

4. The physiological Institute of the University of Göttingen, headed by Professor Dr. Friedrich Hermann Rein.

Dr. Rein, who has been the chairman of the Department of Physiology at Göttingen since 1932, was very cooperative in giving information on a variety of subjects, which included the physiology of reaction to low temperatures, the organization of medical teaching before and during the war, etc. which are embodied in separate reports (see reports on "The treatment of shock from prolonged exposure to cold, especially in water", and "The medical school curriculum in Germany"). Of neurophysiological interest is his work on pain (Rein, F.H: Zur Physiologie des Schmerzes, Schmerz, Narkose, Anästhesie 5: 129 - 139, 1939). According to Dr. Rein, pain sensation is transmitted in separate pain-conducting fibers. The adequate stimuli for the pain receptors are of a chemical nature, and these pain receptors behave in every way like chemoreceptors. In fact, they are chemoreceptors. They consist in non-myelinated fibers which enter into the tissue cells. Their adequate stimulus is any disturbance of the metabolism of that cell, and their function is merely nociceptive in the sense of Hansen. Whenever simple reflex regulation becomes inadequate in controlling metabolic disturbances, pain sets in, which is transmitted by special afferent vegetative fibers. The conformity of the physiology of pain to van't Hoff's law proves that the specific physiologic stimulus which produces pain is a chemical one. The different degrees of sensitiveness to pain exhibited by the various organ systems can be understood in the light of this fact. Muscle tissue, for instance, is not very sensitive to pain, periosteum is very sensitive. Muscle is richly vascularized, and therefore any deviation of its metabolism from the normal is quickly corrected by automatic reflex vasomotor regulation, which allows quick removal or correction of the offending metabolites. Therefore, muscle pain occurs practically only in anoxic muscle. Periosteum, on the

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other hand, is poorly vascularized. Interference with circulation causes pain in any organ system.

5. The Luftfahrtmedizinisches Forschungsinstitut des Reichsluftfahrtministeriums, formerly in Berlin, now evacuated to the Physiological Institute of the University of Göttingen, directed by Professor Dr. med.et phil. Hubertus Strughold, Oberstarzt (Colonel) der Luftwaffe, and professor of physiology with teaching appointment in aviation medicine at the University of Berlin.

Dr. Strughold was interviewed in Göttingen. He was very cooperative, and members of his staff assured me that he was very eager to cooperate to the limit with American authorities, because he felt that any assistance rendered to the United States in accelerating its victory over Japan would be in the ultimate interest of Germany. He added that his only Japanese disciple, a Dr. Miura, was probably sunk in a U-boat on his way back to Japan during the latter part of 1942, and Dr.Strughold appeared so impressed with the high quality of the teaching offered at his institute, that he regarded this event as a severe blow to Japanese aviation medicine. He expressed the hope that his only Chinese pupil, Dr. Ch'ang Tzu Teh (a nephew of Dr. Kung) is alive and active.

Dr. Strughold then went on to explain the organization of the German aviation-medical research institutes. The Surgeon General of the Air Force (Chef des Sanitätswesens der Luftwaffe), who recently was Generaloberstabsarzt Professor Schröder, assisted by his Chief of Staff, Oberstarzt Kanth, headed two major departments: (1) Organization and personnel, and (2) Medi cal procedure and research. The latter was under Dr.Becker-Freysing, who held administrative command over the seven medical research institutes of the Luftwaffe. These were: 1: Luftfahrtmedizinisches Forschungsinstitut Berlin (Dr. Strughold), with its "Aussenabteilungen" at Schloss Welkersdorf, Berlin-Buch (brain research), Göttingen (Physiological Institute) and Brannenburg am Inn; 2: Institut für Luftfahrtpathologie in Freiburg i.B. (Professor Büchner); 3: Institut für Luftfahrtmedizin München(Dr. Weltz) (see report on shock from exposure to cold); 4: Institut für Luftfahrtmedizin Hamburg(Dr.Schwarz); 5: Sanitäts-Versuchs- und Lehr-Gruppe Jüterbog (Professor Knotte); 6: Flugphysiologische Abteilung der Erprobungsstelle Rechlin (Dr. Benzinger); 7: Institut für Flugphysiologie der Deutschen Versuchsanstalt für Luftfahrt Berlin-Allershot (Dr. Buff).

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In his own institute, Dr. Strughold was assisted by 13 collaborators, who were in charge of the different special branches of aviation medicine. They were: 1.Dr. H.J. Clamann: mechanical effects of altitude, experiments on sudden increase of pressure corresponding to falls from high altitudes ("Drucksturzversuche"), low pressure chamber construction, high pressure cabin, high pressure suit; 2. Dr.U.Luft: Adaptation to high altitudes,supervision of low pressure chamber experiments,breathing devices, diet for high altitudes; 3. Dr.E. Opitz: acute anoxia, adaptation to high altitudes, physiology of the coronary system; 4. Dr.F.Palme: electroencephalography, chemoreceptors; 5. Dr.O.Gauer: research on the effects of acceleration, construction of large centrifuges (one at Berlin-Tempelhof airfield, one at 35 Scharnhorststrasse, Berlin); 6.Dr.Hanson: physiology of nutrition, especially in relation to high altitudes; 7.Dr. Desaya: problems of air raid protection; 8.Dr. Schäfer: chemistry; 9. Dr.Rose: spatial perception, night vision; 10.Dr. Ingeborg Schmidt: color vision; 11.Dr.Denser (zoologist): comparative physiology, micro-low-pressure chamber; 12. Dr.Autrum (zoologist): electroretinography, methodology of quantum and nuclear physics, atomic physics; 13. Dr.Suchalla: (geneticist): problems concerning experimental animals. He supervised the breeding of 250,000 white mice and of 70,000 rabbits, 2000 - 3000 of which were farmed out to every air force station (Fliegerhorst).

Dr. Strughold's own interest included selection of flying personnel especially in regard to color vision and night vision. Furthermore, he carried out various studies in the low pressure chamber, especially on the behavior of the postural and muscular reflexes, on reaction time, on the capacity to estimate time, on the problem of nutrition in relation to flying at high altitude, and on reaction time in special relationship to acceleration. Dr. Strughold is in the process of finishing a paper on the latter subject. However, he regarded as his main job during the war the dissemination of information on the fundamentals of aviation medicine to the medical officers of flying personnel, as well as to the manufacturers of aircraft. He wrote a series of teaching letters (Lehrbriefe). He gave one of his last copies of these teaching letters to Colonel Wright, USSTAF. In addition, in collaboration with Dr. Ruff, he published a book on aviation medicine:
RUFF, Siegfried, and STRUGHOLD, Hubertus: "Gundriss der Luftfahrtmedizin: 2nd edition, Leipzig, J.A. Barth,1944.
At present Dr. Strughold is preparing a report on his

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scientific and educational activities during the past 10 years. His educational activity, or, as he put it, "the translation of the scientific results into practical useful knowledge for the use of aviation physicians", was his main preoccupation during the war. He estimated his report will be ready in 4 weeks. When asked about the problem of flying fatigue (referred to in Germany as "abgeflogensein" which freely translated means "to be through flying", or "to be finished as a flier"), he stated that it occurred more frequently among fighter pilots than among other flying personnel. For this reason it was thought that one of the causes for this condition was to be found in the fundamental personality of the fighter pilot who was supposed to be different in personality make-up than other types of fliers. A Dr. Skawran had written a book about it entitled "The Psychology of the Fighter Pilot" ("Die Psychologie des Jagdfliegers"), which was banned and withdrawn from publication as one of the Luftwaffe's consulting physicians, Dr. Anthony, disapproved of it because of its possibly adverse psychological effect upon fliers who might read it. In Dr. Strughold's opinion "the book was not bad; it was interesting". Dr. Strughold happens to know that one existing copy is available in a monastery in Tepl, near Marienbad in Czechoslovakia. The psychological treatment of fliers with fatigue states was in the hands of the psychotherapist Professor von Hattingberg in Halle-Dölau.

Dr. Strughold then went on to generalize on certain major aspects of aviation-medical problems as he saw them developing during the war. He stated that the war could be divided into three phases. In the first phase the problem of the Germans was long distance flights, as against the short, rapid ascents of the British. This explains different avenues of aviation research in the two camps during that phase of the war. In the second phase of the war, the medium heavy medium-distance bomber was the problem on both sides. In the third phase of the war the Germans had to cope with the problem of rapid rise and descent during short flights incidental to the interception of bomber formations at high altitude, while the British and Americans had to solve the problem of long distance flights. In his opinion the present problem of American aviation in the Far East is that of long distance flights at great heights, which includes the problem of aero-embolism. He went on to say that in this recent last phase of German aviation medicine, research was focussed on the problem of nutrition in relation to

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physiological adaptation to rapid ascent and descent. These problems were carried out in experiments by Dr. Hanson, who is nowin Salza, Camp Dora, near Nordhausen.

Of Dr. Strughold's collaborators, Dr. Ingeborg Schmidt and Dr. Franz Palme, were interviewed. Dr. Ingeborg Schmidt devised an apparatus for the testing of color blindness. As to the problem of dark adaptation she stated that she did not think much of the "radium adaptometer" which was at one time widely used in the German Air Force. Dr. Schmidt went on to say that the principle of this adaptometer was unsatisfactory because it did not include a test of visual acuity. However, visual acuity is of special importance in form perception during dark adaptation. Furthermore, she thinks that it is impossible to devise a universal instrument which is equally good for testing the early and late phases of dark adaptation, and that the important problem is not only that of perceiving traces of light in the dark, but also that of recognizing contours, which requires visual acuity. She did feel that Comberg's Nyktometer is a good instrument for testing the first two minutes of dark adaptation.

Dr. Franz Palme, who was a scientific civilian expert employed by the Luftfahrtmedizinisches Institut, specialized in work on chemoreceptors and on electroencephalography, especially in regard to the problem of anoxia during rapid descent similar to descent by parachute from high altitudes. Dr. Palme feels that the critical level of oxygen pressure in the venous blood is 19.8. Adaptation to lack of oxygen is presumably possible mainly by dilatation of capillaries. He stated that he could distinguish three different stagesof deterioration of cerebral function as expressed in the electroencephalogram. The first errors in the writing test, while the individual is subjected to anoxia, occur when 3 per second waves in the brain make their appearance. By these correlations he attempted to objectivize the states of deterioration of cerebral function as produced by anoxia. Palme observed that if patients suffering from states of "abgeflogensein" (flying fatigue states) are exposed to anoxia, slow rhythms appear earlier than in normal controls. Palme, like Kornmüller, convinced himself that in states of fatigue and related vegetative instability, 6 per second activity occurred. These findings were published by A. Bonkáló and R. Grüttner, Archiv für Psychiatrie, 111: 652,1940; but Palme added that these studies concerned themselves with severe acute fatigue and not with chronic fatigue states of the "abgeflogensein" (flying fatigue) type.

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6. The Department of Serology, Experimental Therapy and Spirochaetal Research of the Deutsche Forschungsanstalt für Psychiatrie, Kaiser Wilhelm Institut, in Munich, headed by Dr. F. Jahnel.

Dr. Jahnel is now, in addition to his other duties, director of the entire Forschungsanstalt, as Dr. Rüdin fled on the arrival of the Americans. Dr. Jahnel stated that the special chemical department of which Dr. Page had been in charge until he returned to the United States, had discontinued operation after his departure and that the histological section under Professor W. Scholz is at present at Schloss Oberbrunn, Post Pittenhart, which is on the railway line Endorf-Obing-Chiemgau, in the vicinity of the Chiem lake. He stated that Dr. Scholz had been particularly interested in anoxia, but that only very few brains had been sent to him (Jahnel thought only three altogether), because the Luftwaffe sent the vast majority of them to Dr. F. Büchner in Freiburg.

As to his routine work, Dr. Jahnel carried out serologic examinations for military and civilian hospitals, including examinations of blood and spinal fluid. The annual turnover of his examinations varied somewhat but the period from 1 April 1944 to 1 April 1945 appears representative. During this period examinations of 7,750 cases were performed, of which 5,000 were members of the armed forces, 170 prisoners-of-war , and the remainder civilians. In examining the blood the following serological tests were usually performed: Wassermann reaction; Meinicke-Klärungs reaction II; Kahn test; Müller Ballungs reaction; Lentochol (Sachs-Georgi reaction), and the Citochol reaction (Sachs-Witebsky reaction). In examining the spinal fluid the following reactions were performed: Cell Count per cu.mm.; determination of cell type; Wassermann reaction; Meinicke Klärungs reaction No.2, Müller Ballungs reaction; Nonne test; Pandy test; total albumin according to Kafka; Globulin/albumin ratio; sugar in mg.ms. percent, furthermore, the Normomastix reaction and the Goldsol reaction.

Of scientific investigations Dr. Jahnel was particularly interested in the non-specific positive syphilis reactions occurring in non-syphilitic illnesses, the so-called "false positives", which occurred, for instance, after injection with horse serum, immunization for diphtheria, in and after malaria, and in other conditions (Nos. 1 - 5, Appendix 9). Furthermore, Dr. Jahnel wrote reviews on the pathology, serology and therapy of the syphilitic diseases of the nervous system (Appendix 9, Nos. 6 & 7). Apart from these published papers Dr.Jahnel

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reported preliminary results of confidential work which he carried out for the Wehrmacht, and which were concerned with the serological tests for malaria based on Henry's reaction with iron albuminate (unpublished paper, Appendix 9, No.8). Another confidential report concerns immunological and serological studies of relapsing fever. In these studies he transmitted seven different strains of North African relapsing fever through mice and cultures. They came from seven cases which occurred in the Africa Corps. These cases had originally been mistaken for malaria, but blood tests revealed Spirochaeta recurrens. He found that several of these strains were highly neurotropic. (Unpublished paper, Appendix 9, No.9).

In concluding the interview, certain general problems of psychiatric interest were discussed with Dr.Jahnel (who had been a general neuropsychiatrist before he specialized in serology). Regarding the handling of neurosis problems, Dr. Jahnel feels that in the first world war one had confronted this problem in a helpless manner. He feels this problem has how been solved by means of suggestive treatment with the aid of painful electric currents, as well as by the policy of not letting the patients attain the goals which the illness served. In the last war, the patients definitely felt that they could attain things by their illness, while in this war they could not.

7. The Genealogic Section of the Deutsche Forschungsanstalt für Psychiatrie, Kaiser Wilhelm Institut, in Munich, formerly headed by Dr. E. Rüdin.

On visiting Dr. Rüdin's department I found that he had fled, presumably because of the part that he had played in the program of killing the insane. He felt that some of the relatives of the killed patients might exact retribution from him because in the course of this program not only were incurable defectives killed , but also patients suffering from remedial illnesses, such as depressions or brain tumors. Spot-checking of Dr. Rüdin's files failed to produce any of the material on the organization of the killing centers. I was told that he had destroyed all damaging evidence. However, among the files dealing with international meetings, interesting material was found in three of them. One was a file containing all reports, including confidential ones, concerning the International Neurological Congress and the International Congress for Psychotherapy held in Copenhagen in 1939. This included two confidential reports, one by Professor Kretschmer, the other by Professor Mauz, containing comparisons of

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the status and personnel of German psychotherapy with those of other countries, which will be discussed in another report, to be prepared by me, on German military neuropsychiatry and neurosurgery. Other files, such as those concerning the European Congress on Mental Hygiene held in Prague in August 1938, and the meeting of the International Union for the Scientific Investigation of Population Problems held in Paris in August 1937, contain material which is of interest for a third report in preparation, namely: "Measures concerning public mental health, including sterilization and execution of the insane, in Germany". The report on the Congress in Paris also contained a confidential mimeographed manuscript, entitled "Kongresswesen und Hohe Politik" (International meetings and foreign politics), which contains an interesting set of rules and methods by which participants in International Congresses were supposed to serve the interests of Nazi Germany. This leaflet and associated material from the reports will be made the subject of a special small report entitled: "Methods for Influencing International Scientific Meetings, as laid down by German Scientific Organizations".

8. Conclusions.

The work of a number of scientific organizations in the field of neuropathology and neurphysiology, with special regard to electroencephalography, was reviewed. Among those who worked up the vast material of gunshot wounds of the brain and of other open injuries inflicted by missiles, preoccupation with the problem of infection is striking. This is probably due to the fact that penicillin was unknown or not available in Germany during the war.

In the field of neurophysiology, the electroencephalographic correlates of anoxia and severe acute fatigue states approaching sleep, were thoroughly studied by Kornmüller and his staff. However, the correlation of the findings obtained in severe acute fatigue states with the far less striking and sporadic findings found in the chronic fatigue states of military personnel, especially of aviators (flying fatigue - "abgeflogensein") which was postulated by Kornmüller and others, is not to be considered as proven yet; nor is it a convincing hypothesis that these findings in chronic fatigue states represent an actual structural and irremediable organic change of the brain. Palme's related finding that under conditions of experimental anoxia, slow rhythms can be elicited earlier in patients suffering from flying fatigue than in normal persons, are far more convincing

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in that they allow an interpretation of the picture in terms of functional deviation rather than of static alteration.

The survey reported in this paper unearthed one new invention of great practical interest: namely a signalling apparatus for dangerous slowing of the cerebral electro-activity, such as brought about by anoxia or by intense fatigue approaching sleep. This apparatus is of small convenient size. It was developed by Dr.Kornmüller and Mr. Prast, the latter an oscillograph engineer employed by the Phillips Oscillograph Company, at present in Frankenstein-Vogtland, N51 K86, GSGS 4346, Germany 1: 250,000. The apparatus is at present in the hands of Mr. Prast, and should be obtained from him. The promising potentialities of great practical usefulness of this apparatus are discussed in the body of this report on pages 35 and 36.

LEO ALEXANDER
Major, M.C.

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APPENDIX 1.

I. Luftwaffe (Air Force)

(Aussenstelle für Gehirnforschung des Luftfahrtmedizinisches Forschungsinstitutes)

1. Oberfeldarzt Prof. Spatz
2. Stabsarzt Dr. Lindenberg
3. Stabsarzt Doz. Dr. Peters
4. Stabsarzt Dr.med.habil. Noetzel
5. Stabsarzt Dr.med.habil. Krücke
6. Oberarzt Dr.med.habil. Welte
7. Oberarzt Dr. Seele
8. Stabsarzt Dr. Dinkelmeyer
9. Sonderführer Dr.phil. Grüttner
10. Oberarzt Dr. Gremmler
11. Stabsarzt Dr.med.habil. Link
12. Oberarzt Doz.Dr. Noell
13. Stabsarzt Dr. Klaue
14. Stabsarzt Dr. Lepp
15. Stabsarzt Dr. Knöll
16. Oberstabsarzt Dr. Rotter
17. Stabsarzt Dr. Orthner

II. Heer (Army)

(Aussenstelle der Militärärztlichen Akademie zur Erforschung der Kriegsschäden des Zentralnervensystems).

18. Oberfeldarzt Dr. Patzig
19. Prof. Hallervorden
20. Stabsarzt Dr. Kornmüller
21. Obsrarzt Dr.med.habil. Eicke
22. Stabsarzt Dr. Friedrich
23. Oberarzt Dr. Janzen
24. Stabsarzt Doz. Dr. Volland
25. Stabsarzt Dr. Will
26. Stabsarzt Dr. Graber

III. Civilian Sector

27. Dr. Köpf
28. Dr. Charlotte Krücke
29. Doz. Dr. Zülch
30. Doz. Dr. Selbach++
31. Dr. Bustamante (Madrid) +
32. Dr. v. Bagh (Finland) +
33. Dr. Weisschedel ++
34. Dr. Thea Löers
35. Dr. Herta Lange-Cosack
36. Dr. Vera Gaupp
37. Doz. Dr. Irsigler
38. Dr. Gerlach
39. Dr. Germain Voldet (Genf)+
40. Dr. Gruner
41. Dr. Diepen (Amsterdam)
42. Prof. Tönnis

+ = Stipendiaten der Alexander v. Humboldt-Stiftung
++ = Stipendiaten der Deutschen Forschungsgemeinschaft.

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Appendix 2.

Pathological-anatomical papers on closed and open Injuries of the Central Nervous System from the Aussenabteilung für Gehirnforschung des Luftfahrtmedizinischen Forschungsinstitutes (formerly Gehirnforschungsstelle der Luftwaffe.) (Leiter: Oberfeldarzt Prof. S p a t z) and from the Kaiser-Wilhelm Institut für Hirnforschung.

- from -

1940 to 1945.

I. Published papers:

1). H. S p a t z: Gehirnpathologie im Kriege. Von den Gehirnwunden, Zentralbl. Neurochirurg. 6: 162-212(1941)

2). H.H. D i n k e l m e y e r: Der innere Prellschuss des Gehirnschädels, Nervenarzt 16:110 - 120 (1943).

3). F.J. I r s i g l e r: Über den Heilverlauf experimenteller Hirnwunden bei offener und verlegter Knochenlücke, Zbl. Neurochirurgie 7: 1 - 43 (1942)

4). I r s i g l e r und S t ä d h o f :Experimentelle Untersuchungen über die Infektion von Hirnwunden, Zbl. Neurochirurgie 8: 32 - 106 (1943).

5). G. P e t e r s : Die Gehirnveränderungen bei stumpfer Gewalteinwirkung von vorn (auf die Stirn), Luftfahrtmed. 7: 344 - 379 (1942).

6). G. P e t e r s : Über gedeckte Gehirnverletzungen (Rindenkontusion) im Tierversuch, Zbl. Neurochirugie 8: 172 - 207 (1943).

7). G. P e t e r s und H. S e l b a c h : Über die Neutralisationsfähigkeit des Hirngewebes und ihre Beziehung zu den histopathologischen Veränderungen nach experimentellen Hirnkontusionen, Arch.Psychiatr.116: 531 - 552 (1943).

8). H. N o e t z e l : Über die pathologische Anatomie der traumatischen Meningitis bei Hirnschussverletzung, Arch. Psychiatr. 115: 392 - 418 (1943).

9). H. N o e t z e l : Zur Kenntnis und Abgrenzung des subduralen Empyems, Zbl. Allg.Path.u.Path.Anat.81: 3 - 10 (1943).

10).H. N o e t z e l: Die Mitbeteiligung des Gehirns bei der traumatischen Leptomeningitis, Arch.Psychiatr. 117: 275 - 308 (1944).

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11). W e l t e E: Zur formalen Genese der traumatischen Mydriasis. Oculomotoriuswurzelschädigung durch einseitiges Vorquellen des Uncus hippocampi, Zbl. Neurochirurgie 8: 217 - 234 (1943)

12). H. L e p p : Über odontogene Meningo-Encephalitis mit subduralem Empyem, Dtsch.Zahn-,Mund- u.Kieferheilkinde 10: 379 - 400 (1943).

13). K.H. L i n k : Traumatische subdurale Blutung - Pachymeningitis haemorrhagica, Monographien a.d. Gesamtgebiet d.Konstitutions- u.Wehrpathologie 55: 1 - 120 (1945).

14). K.J. Z ü l c h : Die Entstehung des Hirndrucks, insbesondere des Prolapses bei der Hirnwunde und ihren Folgezuständen. Zbl.Neurochirurgie 6: 212 - 232 (1941) x

II. Papers in Press :

15). R. K l a u e : Über die indirekten Brüche der vorderen Schädelgrube beim Schädelschuss, Zbl. Neurochirurgie.

16). R. K l a u e : Beitrag zur pathologischen Anatomie der Kriegsverletzungen des Rückenmarkes mit besonderer Berücksichtigung der Ruckenmarkskontusion. Ein Vergleich zwischen Rückenmarks- und Gehirnverletzung, Arch. Psychiatrie.

17). E. W e l t e: Zusammenhänge zwischen anatomischem Befund und klinischem Bild bei den Rindenprellungsherden nach stumpfem Schädeltrauma, Arch. Psychiatr. 118: 200 - 267 (1945). (Der bereits fertige Drucksatz wurde bei dem Luftangriff auf Würzburg vernichtet).

18). H. S p a t z: Aus dem Gebiete der Gehirnpathologie mit besonderer Berücksichtigung der Luftfahrtmedizinischen Belange. Festschrift für den Chef des Wehrmacht-Sanitätswesens.

19). H. S p a t z: Kopfverletzungen. Handwörterbuch der Luftfahrt-Medizin.

20). K.H. L i n k: Zur Unfallbegutachtung der subduralen Blutung und der Pachymeningitis haemorrhagica. Zbl. Neurochirurgie.

21). A. K r ü c k e: Die Fettembolie des Gehirns, besonders nach Flugzeugunfällen. Luftfahrtmedizin.

x: Aus der Abteilung für experimentelle Pathologie (Prof. Tönnis) des Kaiser-Wilhelm-Institutes für Hirnforschung.

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22). R. L i n d e n b e r g : Über indirekte Erweichungen bei offenen Verletzungen des Grosshirns und ihre Bedeutung für das klinische Bild. Arch. Psychiatrie 118.

23). K.J. Z ü l c h: Die Konturschüsse des Schädels. Militärarzt.

III. Papers nearly completed

24). G. P e t e r s und H. S p a t z: Die Rindenprellungsherde bei stumpfer Schädelverletzung. Ihre Entwicklung und ihre differentialdiagnostische Bedeutung. Vorgesehen für Ziegler's Beiträge zur anatomischen Pathologie.

25). H. N o e t z e l: Über den äusseren Prellschuss des Hirnschädels (Impressionsschuss ohne Duraverletzung mit Hirnverletzung). Vorgesehen für Zbl. Neurochirurgie.

26). K.H. L i n k : Die Infektion der inneren Liquorräume bei 200 Fällen von Schussverletzungen des Zentralnervensystems.

27). R. L i n d e n b e r g und W. N o e l l: Veränderungen des Gehirns nach Strangulation, beim Flugzeugüberschlag und das Problem der Überlebenszeit. Über die Bedeutung der Klasmatodendrose der Neuroglia.

IV. Investigations in progress

28). E. W e l t e und K. K l o o s: Zum Problem der tödlichen Commotio cerebri.

29). E. W e l t e : Die Hirnstammblutung bei stumpfer Gewalteinwirkung auf den Schädel.

30). E. W e l t e : Anatomisch nachgewiesene Hirnkontusion als Nebenbefund.

31). H. S p a t z: Commotio cerebri und Contusio cerebri auf Grund anatomischer Befunde.

32). H. S p a t z : Die pathologische Anatomie der gedeckten und offenen Verletzungen des Zentralnervensystems.

33). H. N o e t z e l: und H. S p a t z: Das Schicksal der Nekrosen bei der Hirnschussverletzung.

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34). W. R o t t e r: Encephalitis traumatica.

V. Investigations planned:

35). Die Markblutungen bei stumpfer Gewalteinwirkung auf den Schädel. (P e t e r s und W e l t e).

36). Die offened Verletzungen des Rückenmarks. (K l a u e und S p a t z).

37). Der traumatische Hirnabscess (L i n k).

38). Die Entstehung der traumatischen Hirncysten (L i n k)

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APPENDIX 3

PUBLICATIONS FROM THE ANATOMISCHE ABTEILUNG DES KAISER-WILHELM-INSTITUTES

für HIRNFORSCHUNG (PROF. SPATZ)

- From -
1939 to 1945

1. Published papers

1939

1. SPATZ. H. : Pathologische Anatomie der Kreislaufstörungen des Gehirns, Z. Neur. 167, 115 - 171, 1939.

2. LINDENBERG. R. und SPATZ. H.: Über die Thromboendarteritis obliterans der Hirngefässe (Cerebrale Form der v. Winiwarter-Buerger'schen Krankheit), Virchows Arch. 305, 531 - 557, 1939.

2. DRIGGS. M. und SPATZ. H. : Pubertas praecox bei einer hyperplastischen Missbildung des Tuber cinereum, Virchows Arch. 305, 567, 1939

3. WELTE. E. : Die Atrophie des Systems des Brückenfusses und der unteren Oliven, Arch. Psychistr. 109, 650-698, 1939

4. WELTE.E. : Methode der Hirnsektion und makroskopische Diagnostik, Zbl. Allg. Path. u. Path. Anst. 67, 390-400, 1939

5. BEKKER. H. : Experimentelle Verschlüsse von Arterien and Venen des Gehirns und ihre Einwirkung auf das Gewebe, Z. Neur. 167, 546-553, 1939

6. HASENJÄGER. TH. : Über seitenventrikelnahe Gliome als eine besondere Gruppe unter den Grosshirngeschwulsten, Arch. Psychistr. 110, 570-604 1939.

7. HASENJÄGER. TH.: Über die Ependymitis blastomatosa bei ventrikelnahen Gliomen, Arch. Psychiatr. 110, 605-632, 1939

8. SCHÖPE. M. : Zur Frage "Blastom - Encephalitis", Arch. Psychiatr. 109, 755-784, 1939

1940.

9. SPATZ. H. : Oskar Vogt zum 70 Geburtstag, Der Nervenarzt 13, 145-154, 1940

10. Dei POLI.G. und ZUCHA. J. : Beiträge zur Kenntnis der Anomalien und der Erkrankungen der Arteria carotis interna, Zbl. Neurochirurg. 5/6, 209-238, 1940

11. KRÜCKE. CH.: Über das Vorkommen von Knochengewebe in Gehirnarterien, Arch. Psychiatr. 111, 233-250, 1940.

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L"
12. KLAUE. R.: Parkinson'sche Krankheit (Paralysis agitans) und postencephalitischer Parkinsonismus. Versuch einer klinisch-anatomischen Differentialdiagnose, Arch. Psych. 111,251-321, 1940.

1941

13. Bagh. K. v.: Über anatomische Befunde bei 30 Fällen von systematischer Atrophie der Grosshirnrinde (Pickscher Krankheit). Eine vorläufige Mitteilung, Arch. Psychiatr. 114, 68-70 1941.

1942

14. SPATZ. H. : Grundriss der pathologischen Anatomie der Geisteskrankheiten. Lehrbuch d. Geisteskrankheiten von O. Bumke, 5. Aufl. 1942

15. BUSTAMANTE. M., SPATZ. H. und WEISSCHEDEL. E.: Die Bedeutung des Tuber cinereum des Zwischenhirns für das Zustandekommen der Geschlechtsreife, Dtsch. Med. Wschr. 1, 289, 1942.

16. WEISSCHEDEL. E. und SPATZ. H. : Über die gonadotrope Wirksamkeit des Tuber cinereum bei Ratten, Dtsch. Med. Wschr. 1121. 1942.

1943

17. BUSTAMANTE. M. : Experimentelle Untersuchungen über die Leistungen des Hypothalamus besonders bezüglich der Geschlechtsreifung, Arch. Psychiatr. 115, 419-468, 1943.

18. LUERS. TH. : Weitere Mitteilungen zur Klinik und Anatomie der cerebralen Form der Thromboendangiitis obliterans.. (v. Winniwarter-Buerger'sche Krankheit), Arch. Psychistr. 115, 2. H., 319-348 1943.

1944

19. LANGE-COSACK. H. : Die Hydranencephalie (Blasenhirn) als Sonderform der Grosshirnlosigkeit, Arch. Psychistr. 117, 1-51 und 595-640 1944.

11. Papers in press;

20. BAGH. K. v. : Klinische und anatomische Studien an 30 Fällen von Umschriebener Atrophie der Grosshirnrinde (Pick'scher Krankheit), Monographien a.d. Gesamtgebiet f. Psychiatr. u. Neurologie. (Beim Luftangriff auf Leipzig zerstört)

A 103080

H4916-0141

21. SPATZ. H.: Über den Entzündungsbegriff in der Neurologie. Anssprache zum Ref. R ö s s l e ' s, Verhandlung d. Deutschen Pathologischen Gesellschaft in Breslau 1944.

22. GERLACH. J.: Über die Gehirnentwicklung bei den Selachiern.

23. SPATZ. H., GAUPP V. und WEISSCHEDEL. E.: Zwischenhirn und Sexualfunktionen, Arch. Psychiatr.

24. SPATZ. H., DIEPEN. RL und GAUPP.V.: Beitrag zur normalen Anatomie des Tuber cinereum und des Infundibulum beim Kaninchen. Zur Frage der Verbindung zwischen hypothalamischem Sexualzentrum und Hypophyse, Arch. Psychiatr.

111. Papers in progress;

25. SPATZ. H.: Beobachtung über Folgezustande nach intrauteriner Kohlenoxydvergiftung (Fall Scheunert) (zusammen mit Prof. O.V o g t).

26. GAUPP. V., und GRUNER J.: Über den Sitz des Sexualzentrums im Tuber cinereum des Kaninchens.

27. DIEPEN. R.: Vergleichend anatomische Untersuchungen über das Tuber cinereum.

28. LANGE-COSACK. H. : Weiters Beitrage zur pathologischen Anatomie der Pubertas praecox.

29. SPATZ. H. : Wege und Ziele der Hirnforschung.

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APPENDIX 4

MISCELLANEOUS RELATED PUBLICATIONS FROM OTHER DEPARTMENTS OF THE KAISER-WILHELM INSTITUT FUR HIRNFORSCHUNG

- From -

1939 to 1945

Published papers

1939

1. TÖNNIS. W. und GRIPONISSIOTIS. B.: Zur operativen Behandlung der post-traumatischen Spätepilepsie.
Arch. f. Klin. Chirurgie 196, 515-533, 1939

2. TÖNNIS. W. und ZÜLCH. K.J.: Intrakranielle Ganglienzellgeschwülste (mit ausführlicher Beschreibung einer einheitlichen Gruppe im 'Grosshirn), Zentralbl. Neurochirurgie 4, 273-307, 1939.

3. WEBER. E.: Die Teratome und Teratoide des Zentralnervensystems, Zentralbl. f. Neurochirurgie 1, 47-57, 1939.

4. RIESSNER. R. und ZÜLCH K.J.: Über die Formveranderungen des Hirns (Massenverschiebungen, Zisternenverquellungen) bei raumbeengenden Prozessen, Dtsch. Zeitschr. f. Chirurgie 253, 1-61, 1939

5. ZÜLCH. K.J.: Die Gefässversorgung der Gliome, Zeitschr. f. d. ges. Neurolgie u. Psychiatr. 167, 585-592, 1939.

6. ZULCH. K.J.: Zur Klassifikation der Hirntumoren, Psychiatr. -neurolog. Wochenschr. 41. Jahrgang, 3, 1-5,1939. Festausgabe aus Anlass des Eintritts dieser Fach-Wochenschrift in ihr 5 Lebensjahrzehnt.

7. ZULCH. K.J.: Über die Pathologie der Gliome, Fortschritte d. Neurologie Psychiatr. zl. Jahrgang, H. 3, 121-137, 1939

8. ZÜLCH. K.J.: Über die geschichtliche Entwicklung und dem heutigen Stand der Klassifikation der Hirngeschwülste (unter besonderer Berücksichtigung der Gliome).
Zentralbl. f. Neurochirurgie 4/5, 251-335 1939

A 103082

H4916-0143

H4916-0144

1940

9. ANDERS. H.E. und EICKE. W.J.: Die Hirngefässe beim Hochdruck, Arch. Psychiatr. 112, 1-4, 1940

10. PERRET. G. : Experimentelle Untersuchungen über Massenverschiebungen und Formveränderungen des Gehirns bei Volumenzunahme durch Oedem oder Schwellung. Arch. Psychiatr. 112, 385-408, 1940

11. PERRET. G. und SELBACH. H.: Chemische Untersuchungen bei experimentellen Massenverschiebungen und Formveränderungen des Gehirns, Arch. Psychiatr. 112, 441-468, 1940.

12. SELBACH. H.: Physikalisch-chemische Untersuchungen zur Frage der Hirnvolumenvermehrung (Hirnschwellung und Hirnoedem). Arch. Psychiatr. 112 409-440, 1940.

13. ZÜlch. K.J.: Das Medulloblastom vom pathologisch-anatomischen Standpunkt aus, Arch. f. Psychiatr. 112, 343-367, 1940.

14. ZÜLCH. K.J.: Die Pathologie der Hirngeschwülste (insbesonders der Gliome) und ihre Bedeutung für die Klinik. Wiener Klin. Wohschr. Jahrg. 53, 25, S. 498, 1940

15. ZÜLCH. K.J.: Morphologische Befunde bei Hirnschwellung, Zentralbl. f. Neurochirurgie, 5. Jahrgang 4, 166-175, 1940.

16. ZÜLCH. K.J.: Hirngeschwulste im Jugendalter. Zentralbl. f. Neurochirurgie, 5. Jahrgang 5/6, 238-274 1940.

1942

1. TÖNNIS. W. : Richtlinien fur die Behandlung der Schussverletzungen des Gehirns und die Beurteilung ihrere Folgezustände. 1-73, J.F. Lehmann München 1942

1943.

1. STENDER A. und ZÜLCH. K.J.: Uber die Ventrikeltumoren bei tuberoser Sklerose Zeitschr. f.d. Ges. Neurol. u. Psychiatr. 176, 556-578 1943.

2. ZÜLCH. K.J.: Hirnoedem und Hirnschwellung, Virchows Arch. 310, S 1-58 1943.

A 103083

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APPENDIX 5

INDEX OF PUBLICATIONS FROM DR. HALLERVORDEN'S SPECIAL PATHOLOGIE SECTION

OF THE KAISER WILHELM INSTITUT FUR HIRNFORSCHUNG *

- From -

1939 to 1945

1939

1. Über Spätfolgen von Hirnschwellung und Hirnödem, namentlich bei Schwachsinnigen und Idioten.
Vorläufige Mitteilung, Psychiatr. -neurolog. Wschr. 2, 1939.

(Kreislaufstörungen in der Ätiologie des angeborenen Schwachsinns.
Vortrag in der Berliner Path. Ges. 12. 1. 1939.)

(Hydrocephalus infolge von atrophischen Degenerationsprozessen. Vortrag in der Berliner Gesellschaft für Kinderheilkunde. 17. 2. 39)

2. Kreislaufstörungen in der Ätiologie des angeborenen Schwachsinns, Z. Neur. 167, 527.

3. Über die Einrichtung von Prosekturen in Heil- und Pflegeanstalten.
Referat für den Ausschuss für prakt. Psychiatrie in der Gesellschaft der Neurologen und Psychiater. Wiesbaden 1939, Z. Psych. Hyg. 12, 121.

4. Über zentrale Entmarkungskrankheiten. Ref. auf der 64. Wanderversammlung der südwestdeutschen Neurologen-und Psychiater in Baden-Baden. 3. 6. 39., Dtsch. Z. f. Nervenheilk. 150, 201, 1940.

5. Balthassar, Über die Beteiligung des Globus pallidus bei Athetose und Paraballismus, Dtsch. Z. Nervenheilk. 148, 243.

6. Krücke. W. Die mukoide Degeneration der peripheren Nerven, Virchow's Archiv, 304, 442.

1940

7. Volland. W. Über intracerebrale Gefässverkalkungen: Die idiopathische Form mit vorwiegend extrapyramidalem Krankheitsbild nebst Bemerkungen zur Sturge-Weberschen Krankheit, Arch. Psychiatr. 111, 5

8. Poetzel. H. Diffusion von Blutfarbstoff in der inneren Randzone und äusseren Oberfläche des Zentral nervensystems bei subarachnoidaler Blutung, Arch. für Psychiatr. 111, 129

9. Laubenthal. F. und Hallervorden. J. Über ein Geschwisterpaar mit einer eigenartigen frühkindlichen Hirnerkrankung und seiner Sippe, Arch. für Psychiatr. 111, 712.

* All numbered publications are available in microfilm through CIOS Secretariat.

103084

10. Eicke. W.J. Neue Beobachtung über die Hallevorden-Spatzsche Krankheit Arch. Psychiatr. 111,614

11. Ammermann, Isolierte Schädigung der unteren Olive bei Myoklonusepilepsiee Arch. Psychiatr. 111, 215.

12. Lenz, Hirnveränderungen nach einem 10 Monate vor den Tode vorgenommenen Erhängungsversuch. D. I. Berlin 1940

Nekrolog Oskar Rein, Psychiatr, Neurol. Wschr. 33, 1940 (not available)

1941

13. Hirnerschutterung und Thixotropie. Zbl. Neurochir. 37, 1941.

14. Birnbaum, Chronisch progressive Chorea mit Kleinhirnatrophie, Arch. Psychiatr. 114, 160

15. Eicke. W.J. Wilson-Pseudosklerose ohne Lebercirrhose, Arch. Psychiatr. 114, 214

16. Götze. W. und Krücke. W. Über Paramyloidose mit besonderer Beteiligung der peripheren Nerven und granulärer Atrophie des Gehirns, Archiv. für Psychiatr. 114, 183

17. Krücke. W. Odem und seröse Entzundung im peripheren Nervem, Virchows Archiv 1 , 308

1942

18. Krücke. W. Zur Hispopathologie der neuralen Muskelatrophie,der hypertrophischen Neuritis und der Neurofibromatose, Arch. Psychiatr. 115,180

19. Volland. W. Beitrag zur Kenntnis der Gehirnschäden bei Trichinose, Arch. Psychiatr. 115, 349

20. Die pathologisch anatomischen Veränderungen im Zentralvervensystem beim Fleckfieber, Militärarzt 8, 26

(Hirnschädigung nach Kohlenoxydvergiftung im Mutterleib. Vortrag in der Neurologisch-Psychiatrischen Gesellschaft in Berlin. 14.12.42.) not available.

1943

21. Eicke. W.J. Beitrag zur Pathologie der Aubstantia nigra, Archiv Psychiatr. 115, 549

22. Nekrolog Franz Schob, Arch. Psychiatr. 116, 347

23. Encephalitis und Polyneuritis, Nervenarzt 16, 417

24. Eicke. W.J. zum Frage der fetalen Encephalitis, Meningitis und ihrer Folgeerscheinungen, Arch. Psychiatr. 116, 568

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A 103085

H4916-0147

1944/45

25. Oligodendroglion nach Hirntrauma, Arch. f. Psychiatr. ?

26. Seltenere Formen encephalitischer Erkrankungen: Infedtiöse Granulome und blastomencephalitis. Beitrag zur Festschrift für Handloser (nicht gedruckt)

27. Über multiple und konzentrische Sklerose. Vortrag in der med. naturwissenschaftl. Ges. in Jena 16.11.44 (wird später in den Schriften der Gesellschaft erscheinen).

28 Vom Bau und Leben des Gehirns. Öffentlicher Vortrag Dillenburg. 3.2.45 not available

Wilke, Über eigenartige entzündliche Erkrankungen der Zentralnervensystems: Infektiöse Granulome des Gehirns. Zugleich ein Beitrag zur Frage : Blastom-Encephalitis. (Vortrag 20.3.44 in der Psychiatr. Ges. in Berlin) Soll in Virchows Archiv erscheinen. not available.

28. Volland. W. Zur Frage der parainfektiösen (perivenösen) Encephalitis (Impf- und Masernencephalitis). Virusinfektion oder allergische Krankheit? Druckgenehmigung versagt. Ein Vortrag gleichen Inhaltes auf der Pathologischen Gesellschaft in Breslau, Juni 1944.

29. Eicke. W.J. Gefässveranderungen bei Meningitis und ihre Bedeutung für die Pathogensse frühkindlicher Hirnschäden. Habilitationsschrift soll in Virchows Arch. erscheinen.

A 103086

H4916-0148

APPENDIX. 6

PUBLICATIONS BY DR. A.E. KORNMULLER AND HIS COLLABORATORS, 1939-1944 *

1. R. JANZEN und A.E. KORNMULLER. Örtliche Unterschiede hirnbioelektrischer Erscheinungen von kranken Menschen bei Ableitung durch die Kopfschwarte, Arch. f. Psychiatr. 109, 247 1939

2. R. JANZEN und A.E. KORNMULLER. Einige Erforschungen über die Anwendung der hirnbioelektrischen Lokaldiagnose kortikaler Prozesse bei Ableitung durch die Kopfschwarte des Menschen, Psychiatr. neur. Wschr. 41, 5, 1939

3. A.E. KORNMULLER und R. JANZEN. Die Methodik der lokalisierten Ableitungen hirnbioelktrischer Erscheinungen von der Kopfschwarte des Menschen, ihre Begründung und Begrenzung, Z. Neur. 166, 287, 1939

4. R. JANZEN und A.E. KORNMULLER. Hirnbioelektrische Erscheinungen bei Änderungen der Bewustseinslage, Dtsch. Z. Nervenheilk. 149, 74, 1939

5. A.E. KORNMULLER und R. JANZEN. Über die normalen bioelektrischen Erscheinungen des menschlichen Gehirns. (Gleichzeitig eine kritische Stellungnahme zu den bisherigen Anschauungen auf Grund neuer Befunde an Gesunden und Kranken), Arch. f. Psychiatr. 110, 224, 1939.

6. A.E. KORNMULLER. Neuere Ergebnisse der hirnbioelektrischen Untersuchungen an gesunden Menschen.
Vortr. Berl. Ges. f. Psychiatr. Neur. Sitzung vom 10.V.1939, ZBl. Neur.

7. A.E. KORNMULLER. Einige Voraussetzungen der hirnbioelektrischen Untersuchung des Menschen, Dtsch. med. Wschr. 42, 1601, 1939

8. A.E. KORNMULLER. Weitere Ergebnisse über die normalen hirnbioelektrischen Erscheinungen des Menschen bei Ableitung durch die Kopfschwarte. Einblicke in den Mechanismus der corticalen Erregungsabläufe und in die regionale Gliederung der Hirnrinde, Z. Neur. 168, 248, 1940

9. A.E. KORNMULLER. Über einige bei Willkürbewegungen und auf Sinnesreize auftretende bioelektrische Erscheinungen der Hirnrinde des Menschen, Z. Sinnesphysiol. 68, 119, 1940.

10. A.E. KORNMULLER. Voraussetzungen und Grenzen der Erfassung hirnbioelektrischer Erscheinungen des Menschen mit Hilfe lokalisierter Ableitungen von der Kopfschwarte, Ber. 111. Internat. Neurol.-Kongr. Kopenhagen August 1939, 488

* The publications marked by asterisks are available in microfilm form through the CIOS Secretariat.

A 103087

11. A.E. KORNMÜLLER. Einige weitere Erfahrungen über die Lokalisation von Tumoren und anderen herdförmigen Erkrankungen des Gehirns mittels der hirnbioelektrischen Lokalisationsmethodik, Zbl. Neurochir. 5, Jg. Nr 2, 75, 1940

12. R. JANZEN und A.E. KORNMÜLLER. Hirnbioelektrische Untersuchungen an Kranken mit symptomatischer Epilepsie, Dtsch. Z. Nervenheilk. 150, 283 1940

13. A.E.KORNMÜLLER. Die hirnbioelektrische Untersuchung des Menschen . I. Die Grundlage der Methodik und das Verhalten des Gesunden, Fortschr. Neur. etc. 11, 193 1940

14. A.E.KORNMÜLLER und R. Janzen. Hirnbioelektrische Untersuchungen bei genuiner Epilepsie, Dtsch. Z. Nervenheilk. 152, 78, 1941

15. A.E. KORNMÜLLER, F. Palme und H. Strughold. Über Veränderungen der Gehirnaktionsströme in akutem Sauerstoffmangel, Luft. Med. 5, 161, 1941

16. A.E.KORNMÜLLER. Hans Berger, Münch. Med. Wschr. 32, S. 889, 1941

17. A.E.KORNMÜLLER. Zur Pathenogenese der genuinen Epilepsie und anderer Anfallskrankheiten auf Grund hirnelektrischer Befunde, Arch. f. Psychiatr. 114, 25, 1941

18. A.E.KORNMÜLLER,F. PALME und H. STRUGHOLD. Die Ableitung der Gehirnaktionsströme. Eine Methode zur Untersuchung der Höhenkrankheit,
Kli. Wo. 21,5-8. 1942
Jb. Luft. Med.

19. A.E. KORNMÜLLER. Die Wirkung der Kohlensaure bei Epilepsie und Schizophrenie auf Grund hirnelektrischer Befunde,
Münch. Med. Wschr. , No. 2, 30, 1942

20. NOELL, KORNMÜLLER und Gremmler: Uber den Paradoxeffekt der Sauerstoffgabe, Arch. f. Psych. 116, 3, Heft, S. 394-416, 1943

21. A.E.KORNMÜLLER. Die klinische Bewertung der Elektrenkephalogramme, Arch. f. Psych. 116, 4, Heft, S. 608-647, 1943

22. A.E.KORNMÜLLER, Gremmler: Praepileptische Zeichen in Elektrenkephalogrammen von Kopfverletzten,
Kli. Wo. 153, 22-23, 1944

23. A.E. KORNMÜLLER,u. W.NOELL: Uber den Einfluss der Kohlensäurespannung auf bioelektrische Hirnrindenphänomene,
Pflugers Arch. 247, Band, 6. Heft, S. 660-684 1944

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24. W. NOELL u. A.E. KORNMÜLLER. Zur Sauerstoffmangelwirkung auf die Hirnrinde, Pflügers Arch. 247, Band, 6. Heft, S. 685-712., 1944

25. A.E.KORNMÜLLER u. W. NOELL. Zur Frage der Beinflussung der Sauerstoffmangelwirkung durch Kohlensäure, Pflügers Arch. 247. Band, 6. Heft. S.

26. A.E. KORNMÜLLER: Klinische Elektrenkephalographie, J.F. Lehmanns Verlag 1944, Monographie, 1-147

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APPENDIX 7

Additional physiological papers from the Aussenabteilung für Gehirnforschung des Luftfahrtmedizinischen Forschungsinstitute

- From -
1941 to 1945

Published papers

1941

1. NOELL. W.,& SCHNEIDER .M.: Die Gehirndurchblutung bei Sauerstoffmangel und bei Übergang von Sauerstoffmangel auf reinen O2 und auf O2/CO2.-gemische, Luftfahrtmedizin. 5, 234-250, 1941

2. NOELL.W. & SCHNEIDER. M.: Über die Wirkung der Kohlensäure auf Blutdruck und Gehirndurchblutung im Sauerstoffmangel, Luftfahrtmedizin, 5, 251-262, 1941

1942

3. NOELL.W. : Über die Wirkung des Theophyllins und der verschiedenen Lösungsvermittler auf die Gehirndurchblutung, Zeitschrift für die gesamte experimentelle Medizin. 110, 589-600, 1942

4. NOELL. W. & SCHNEIDER M.: Über die Durchblutung und die Sauerstoffversorgung des Gehirns im akuten Sauerstoffmangel, 1. Mitteilung: Pflügers Archiv 246: 181-200, 1942

5. NOELL.W. & SCHNEIDER. M.: Über die Durchblutung und die Sauerstoffversorgung des Gehirns im akuten Sauerstoffmangel, 11. Mitteilung : Der Liquordruck, Pflügers Archiv. 246: 201-206, 1942

6. NOELL.W. & SCHNEIDER M.: Über die Durchblutung und die Sauerstoffversorgung des Gehirns im akuten Sauerstoffmangel, 111. Mitteilung: Die arterio-venöse Sauerstoffmangel und Kohlensäuredifferenz. Pflügers Archiv, 246, 207-249, 1942

7. GREMMLER. J.: Die Beziehungen der Hypoxämie zum epileptischen Anfall und zu den Höhenkrampfen. Der Nervenarzt 15, 467-476, 1942

1943

8. NOELL. W. und ROEDER.W. : Zur Erholung aus Sauerstoffmangelinsbesondere über der Paradoxeffect der Sauerstoffgabe. Luftfahrtmedizin. 8, 339-356, 1943

9. NOELL.W. & SCHNEIDER.M: Über die Flimmerbereitschaft des Herzens in der Erholung nach schwerstem Sauerstoffmangel,Zeitschrift für die gesamte experimentelle Medizin. 113. 270-281, 1943

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9. NOELL.W. & SCHNEIDER .M.: Über die Flimmerbereitschaft des Herzens in Erholung nach schwerstem Sauerstoffmangel, Zeitschrift für die gesamte experimentelle Medizin, 113: 270-281, 1943

10. NOELL.W. & SCHNEIDER. M.: Über die Durchblutung und die Sauerstoffversorgung des Gehirns, IV. Mitteilung: Die Rolle der Kohlensäure, Pflügers Archiv 247: 514-527, 1943

11. NOELL. W. Über die Durchblutung und die Sauerstoffversorgung des Gehirns V. Mitteilung: Einfluss der Blutdrucksenkung. Pflügers Archiv. 247, 528-552, 1943

12. NOELL. W. Über die Durchblutung und die Sauerstoffversorgung des Gehirns VI. Mitteilung: Einfluss der Hypozäure und Anäure, 247, 553-575, 1943

B[illegible]ers in press

13. NOELL. W: Wiederbelebenszeit und Überlebenszeit des Gehirns bei Anoxie, Arch. Psychiatrie.

14. NOELL.W.: Über die Bluasaurewirkung auf das Gehirn im Vergleich zur Hypoxämie, Arch. Psychiatrie.

15. NOELLE. W, : Der Einfluss von Kalte und Warme auf das Elektrenkephalogramm, Arch. Psychiatrie.

16. KORNMÜLLER. A.E. : "Elektrenkephalographie". Handworterbuch d. Luftfahrmedizin.

17. NOELL.W: "Höhenkrämpfe". "Paradoxeffekt der Sauerstoffgabe." Handwörterbuch der Luftfahrtmedizin.

18. NOELL.W.: Uber den Einsatz der hirnelektrischen Untersuchungsmethode in der Luftfahrtmedizin. Festschrift für den Chef des Wehrmachtsanitätswesens

19. GRÜTTNER. R: Uber das Verhalten des optokinetischen Nystagmus bei akuten Sauerstoffmangel.

111. Studies in progress:

20. NOELL.W.: Die Sauerstoffmangelwirkung auf subcortipale Systeme auf Grund elektrenkephalographischer Untersuchungen.

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21. KORNMÜLLER. A.E. und NOELL. W: Über die Vulnerabilität verschiedener Hirngebiete bei Hypoxämie.

22. KORNMÜLLER A.E. und NOELL.W.: Über die bioelektrischen Phänomene bei Hyperventilation und ihre Abhängigkeit von der Sauerstoffversorgung.

23. HOELL.W: Über den Einfluss der Liquordrucksteigerung auf die Durchblutung des Gehirns.

24. GREMMLER. J: Hirnelektrische Untersuchungen bei Kranken mit Commotio cerebri.

25. KORNMÜLLER A.E.: Hirnelektrische Untersuchungen bei Folgezuständen nach Gehirnverletzung.

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Appendix 8.

List of reprints by Dr. F. Palme and co-workers, in Dr. Strughold's Laboratory

BEIGEL,A, HAARSTRICK,R.,and PALME,F: Untersuchung der Hirnaktionsströme nach Sauerstoffatmung in verschiedenen Höhenlagen, Luftfahrtmedizin, 7: 305 - 318, 1942.

BEIGEL,A, HAARSTRICK,R., and PALME,F: Höhenumstellung (Hirnaktionsströme) nach Unterbrechung der Sauerstoffzufuhr, Ibidem,7: 319 - 334, 1941.

DUNKER,E., and PALME,F: Die Bedeutung verschiedener Formen willkürlicher Hyperventilation bei normaler und herabgesetzter Sauerstoffspannung in der Einatmungsluft, Ibidem, 8: 381 - 403, 1942.

OPITZ,E., and PALME,F: Darstellung der Höhenanpassung in Gebirge durch Sauerstoffmangel,III Mitt.: Graduierung der Höhen Krankheit durch das Electroencephalogram, Pflügers Archiv für die gesamte Physiologie des Menschen und der Tiere, 248: 330-375, 1944.

GRÜTERING,F, OPITZ,E. and PALME,F: Darstellung der Höhenanpassung im Gebirge durch Sauerstoffmangel, IV.Mitt.:Steigerung der alveolaren Höhenfestigkeit untersucht am Schriftbild, Pflügers Archiv für die gesamte Physiologie des Menschen und der Tiere, 248: 376 - 386, 1944.

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Appendix 9.

List of Serological and Immunological Papers by Dr.F. Jahnel

A. **Published papers** :

1). JAHNEL F: Ueber das Vorkommen positiver Wassermann- und Flockungsreaktionen im Serum anscheinend gesunder Hammel, Zeitschrift für Immunitätsforschung, 98: 306 - 314, 1940.

2). JAHNEL F: Ueber positive Luesreaktionen im Rinderserum. Zeitschrift für Immunitätsforschung 98: 453 - 462, 1940.

3). JAHNEL F: Stark positive, nicht auf syphilis beruhende Luesreaktionen im Blute bei einer Bestimmten Erkrankung der Atmungsorgane und ihre Praktische Bedeutung, Klinische Wochenschrift, 20: 1089 - 1093, 1941.

4). JAHNEL F: Ueber positive Luesreaktionen in Blut und Liquor nach Einspritzung von artfremdem Serum, Münchener medizinische Wochenschrift, Nr. 30: 828. 1941.

5). JAHNEL F: Ueber das Vorkommen positiver Luesreaktionen im Serum von Pferden, Zeitschrift für Immunitätsforschung, 99: 451 - 459, 1941.

6). JAHNEL F: Neuere Untersuchungen über die Pathologie und Therapie der syphilogenen Erkankungen des Gehirns und Rückenmarks (Lues cerebrospinalis, Lues cerebri, Lues spinalis, Tabes), Fortschritte der Neurologie, Psychiatrie und ihrer Grenzgebiete: 13: 375 - 398, 1941.

7). JAHNEL F: Die progressive Paralyse und die syphilitischen Geistesstörungen, Fortschritte der Neurologie, Psychiatrie und ihrer Granzgebiete, 15: 99-130, 1943.

B. **Unpublished reports**:

8). JAHNEL F: Serologische Besonderheiten des Malariablutes, Forschungsauftrag, Tgb. Nr.5077/44. Bezug: HSJn/44 WIGJbbv. 5. 9. 44. 16.9.44.

9). JAHNEL F: Erforschung der verschiedenen Eigenschaften von Rückfallfieberstämmen zwecks Gewinnung näherer Einsicht in die Genese des Rückfallfiebers und anderer Spirochäteninfektionen, Forschungsauftrag, Tgb.Nr.5977/44. Besug: HSJn 5913/44, WIGJbbv. 5.9.44. 16 September 1944.

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FOR THE PROSECUTION OF AXIS CRIMINALITY

Doc. No. L170 APO 413 Date 23 August 1945

STAFF EVIDENCE ANALYSIS

DESCRIPTION OF ATTACHED DOCUMENT (Under following headings).

Title and Nature: Neuropathology and Neurophsiology, etc. in wartime Germany written by Major Leo Alexander, MC, ETOUSA, published by CIOS, containing references to killing centers for the insane.

Date: Undated Original (x) Copy ( ) Language: English

If not English, is translation attached: Yes ( ) No ( )

LOCATION OF ORIGINAL (also WITNESS if applicable) as of _____ 1945:

PERSONS IMPLICATED:

REFERENCES TO INDEX HEADINGS (Key to Par. nos. of Summary below):

ATROCITIES: Against Civilians (1)

NECESSARY PROCESSING TO PUT IN EVIDENTIARY FORM; LEADS:

Authentication by Major Alexander.

SUMMARY OF RELEVANT POINTS (with page references):

1. Patients in mental institutions were killed by gas in such large numbers that autopsies were impossible. The brains, however, were suspended in formalin and sent to laboratories for examination. Nurses and attendants selected the persons to be killed, and they degenerated to picking out the patients who looked sick, or who were problems, or whom they simply disliked. (20-21).

Note: This is only a small part of the report, but it might be used in connection with the report on execution of mental patients. (L-169)

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Kenyon

NOTE: DO NOT MARK, UNDERLINE OR OTHERWISE DEFACE ATTACHED DOCUMENT DOC.NO.L170

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1427

D O C U M E N T N° R.F. 684

Extrait du Document L.I70
(Rapport du Major Leo
(ALEXANDER - en date du 20
(JUILLET 1945, relatif aux
(expériences du " Kaiser
(Wilhelm Institut".

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Ich, E. HANDRICH, Professeur agrégé de l'Universit
(Paris), bestätige hiermit, daß dies eine wortgetreue
Uebersetzung aus dem Englischen ins Deutsche eines
Auszugs aus dem Dokument NEUROPATHOLOGIE usw. ...
Bericht von Leo ALEXANDER (Dok. L 170) ist.

Der englische Auszug sowie die deutsche Uebersetzu
tragen das Aktenzeichen : R.F. 684).

E. Handrich

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H4916-0159

(Dok. RF. 684)

AUSZUG AUS DEM DOKUMENT :

NEUROPATHOLOGIE UND NEUROPHYSIOLOGIE, EINSCHLIESSLICH ELEKTROENZEPHALOGRAPHIE WAEHREND DES KRIEGES IN DEUTSCHLAND.

Bericht von LEO ALEXANDER
Major, MC., AUS
Hd. ETOUSA
den 20. Juli 1945

CIOS VEROEFFENTLICHUNG 24 - AERZTLICH

(Combined Intelligence Objectives Sub-Committee
G-2 Division SHAEF (Rear) APO 413)

(Seite 20 u. 21)

.....

Dr. HALLERVORDEN hatte 500 Gehirne von den Tötungszentern für Geisteskranke bekommen. Diese Kranken waren in verschiedenen Anstalten durch Kohlenmonoxydgas umgebracht worden. DR. HALLERVORDEN weihte selbst das Personal zu dieser Arbeit ein. Wie er selbst erklärt :/"Ich hörte,dass sie im Begriff waren, das auszuführen, so ging ich zu ihnen und sagte "Seht mal zu, Kinder, wenn ihr all diese Leute töten wollt, so sollt ihr wenigstens die Gehirne herausnehmen, damit das Material gebraucht werden kann". Sie fragten mich : "Wie viel können Sie untersuchen ?" und so antwortete ich : "eine unbegrenzte Zahl, jemehr, desto besser". Ich gab ihnen die Fixative, Gefässe und Kisten, sowie Anweisungen zum Entfernen und Fixieren der Gehirne und dann brachten sie dieselben wie der Lieferungswagen der Möbelgesellschaft. Die "Gemeinnützige Krankentransport-Gesellschaft" brachte die Gehirne in Lieferungen von je 150-250 Stück."

Der Mann, der diesen Dienst leitete, war Dr. HEGENER, ein Pädiater aus Berlin, an den sich Dr. HALLERVORDEN als an einen verschrobenen und hochfahrenden Kerl erinnert, der immer von sich selber sprach. "Es war wundervolles Material unter diesen Gehirnen, schöne Geistesfehler, Missbildungen und frühe Kinderkrankheiten. Ich nahm diese Gehirne selbstverständlich an. Woher und wie sie zu mir kamen, ging mich wirklich nicht an". Dr. HALLERVORDEN sagte weiter " Dieses Ding war ein schönes Durcheinander

Ausser dem Material das er brauchte, waren allerlei andere Fälle darunter, wie z.B. Kranke, die an verschiedenen Formen der Parkinsonschen Krankeit litten, Fälle einfacher Depression, verwickelter Depression, Hirngeschwüre und allerlei andere Krankheitsfälle, einschliesslich Psychopathen, derer Behandlung schwierig war. "Diese wurden von den verschiedenen Wächtern und schnellen Methode ausgewählt. Die meisten Anstalten hatten nicht genug Aerzte, und soweit sie Aerzte hatten, so waren dieselben entweder zu sehr beschäftigt oder sie kümmerten sich nicht darum und sie überliessen den Pflegerinnen und Sanitätern die Wahl. Wer krank oder sonst den Sanitätern ein Problem war,vom Gesichtspunkt der Pflegerinnen oder Sanitäter aus, wurde in eine Liste eingetragen und wurde zur Vernichtungsstelle transportiert. Das schlimmste bei der Geschichte war, dass es eine gewisse Brutalität von Seiten des Sanitätspersonals mit sich brachte. Es war

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ihnen freigelassen, einfach die herauszunehmen, die sie nicht gern hatten und die Aerzte hatten so viele Kranke, dass sie dieselben nicht einmal kannten und ihre Namen auf die Liste eintrugen". Von den auf diese Weise getöteten Patienten, wurden nur die Gehirne dem Dr. HALVORDEN geschickt. Sie wurden in solchen Mengen getötet, dass die Autopsie der Körper unmöglich war. Letzteres in Dr. HALVORDEN Meinung vermindert beträchtlich den wissenschaftlichen Wert des Materials. Die Gehirne waren aber immer richtig in Formalin fixiert und befestigt, genau nach den gegebenen Anweisungen. Wenn er an diese Zeit zurückdenkt, erklärte Dr. HALLERVORDEN, dass es ihm immer ein wenig ekelte, wenn eine neue Sendung ankam. Es wurden ihm auch Gehirne von Schizophrenikern und Epileptikern angeboten, die er aber abwies nicht etwa aus moralischer Entrüstung - sondern weil er den Eindruck hatte, dass nichts von Belang darin gefunden werden konnte. Er denkt, dass diese Handlung der Sache der Psychiater fortwährend geschadet hat und dass die Psychiater die Achtun des deutschen Volks auf immer verloren haben.

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I hereby certify that the annexed document L-170 No. RF-1427 is a photostat of an original document submitted in evidence by the ~~United States~~ French Prosecution under this number. The original document has been withdrawn in accordance with Rule 10 of the International Military Tribunal, and to the best of my knowledge and belief is to be held at the National Archives, Washington D.C. .

Nürnberg, 20. 8. 48

Paul Joosten

PAUL A. JOOSTEN

General Secretary
International Military
Tribunal

H4916-0162

OFFICE OF CHIEF OF COUNSEL FOR WAR CRIMES

EVIDENCE DIVISION

Date: 20. 8. 48

I certify that Document Number L-175 was introduced into evidence as Exhibit Number RF-1427 in the Trial by the International Tribunal of Hermann GOERING, et al., which commenced on 20 November 1945, and that the attached photostat is a true and correct copy of the original.

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